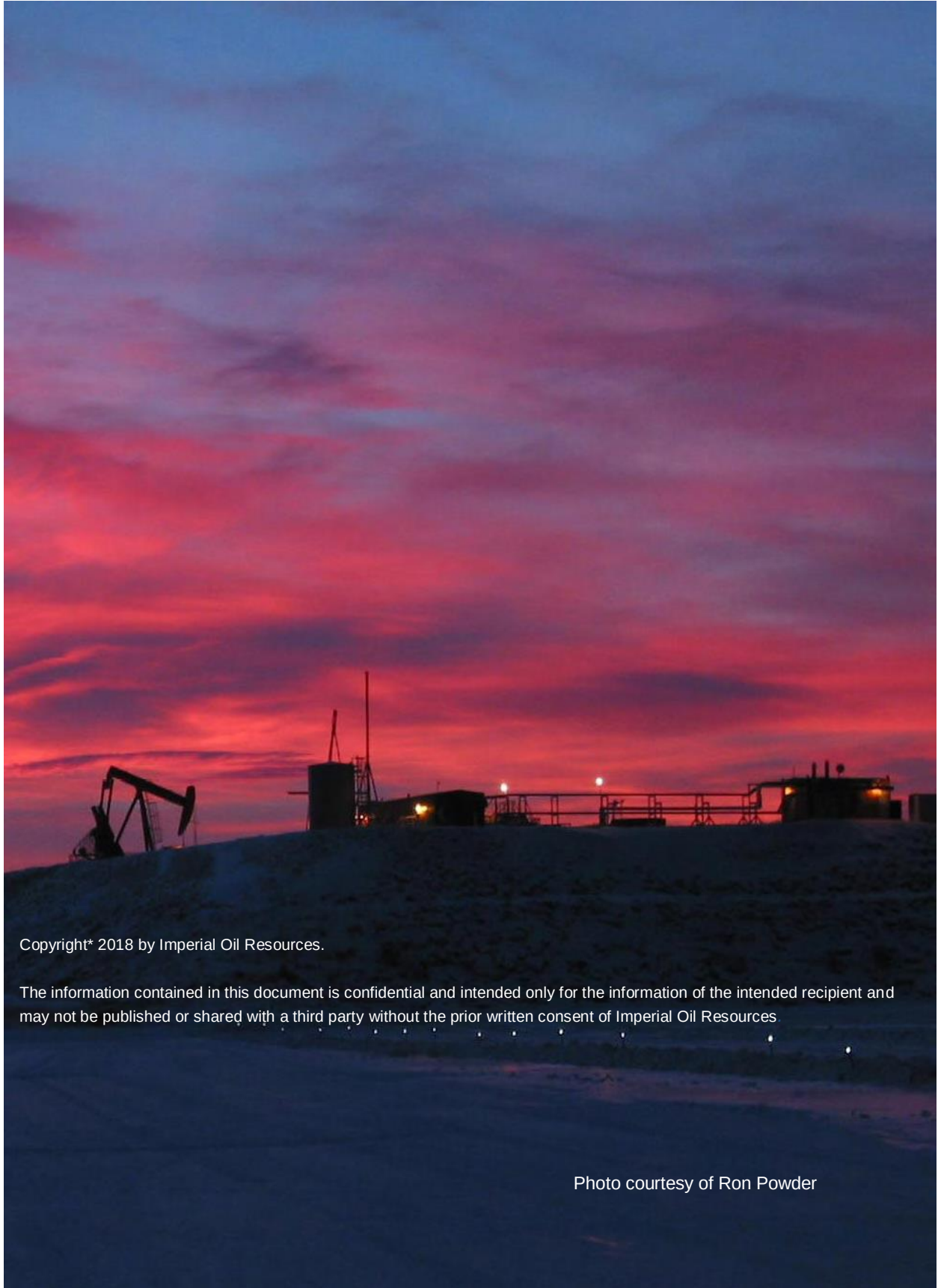


Norman Wells Operations 2021 Annual Water Use Report

Operations Authorization 1210-001
Report No. 36

March 2022

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1.0 Introduction

As required by Type A Water Licence S13L1-007 (Part B: Item 13), the Licensee shall file an Annual Report with the Board no later than March 31st of the year following the calendar year reported. Details on the licence requirements and corresponding applicable section(s) within the report can be found below.

Table 1-1: Concordance Table

Licence Requirement		Section of Report
a)	The monthly and annual quantities in cubic meters of freshwater obtained from all sources	3.0
b)	The monthly and annual quantities in cubic meters of each and all Waste discharged	3.0– 5.0
c)	The monthly and annual quantity in cubic meters of Waste discharged to the Mackenzie River at SNP station S13L1-007-2	3.0
d)	The monthly and annual quantities in cubic meters of freshwater and produced water injected to the Waterflood	4.0
e)	The monthly and annual quantities in cubic meters of Waters contained and discharged from the Surface Water Run-off Facilities	5.0
f)	The monthly and annual quantity in cubic meters of Produced Water recovered from the oilfield reservoir	4.0
g)	Tabular summaries of all data generated under the Surveillance Network Program (SNP)	Appendix A & B & C
h)	A list of unauthorized discharges, identification of waterbodies affected and the current status of mitigation measures	7.0
i)	An annual drilling schedule for the upcoming year to the Board	8.0
j)	The annual amounts in cubic meters of water and Waste generated from all drilling activities	8.0
k)	A summary of measures taken to minimize net water withdrawals from the hydrological cycle as required in Part D, Item 4 of the licence	3.0– 5.0
l)	Details on the handling, storage, treatment and disposal of Waste from the Norman Wells Proven Area	9.0
m)	A review of spill training and communication exercises of the previous year, including the success and failure, as well as recommendations for improvement	10.0
n)	A general schedule for any planned oil spill exercises for the following year	10.0
o)	A summary of any Modification(s) and / or major maintenance work carried out as per Part G of the licence	11.0
p)	Any other details on Water(s) use or Waste(s) disposal requested by the Board no later than March 31st of the following calendar year reported	n/a
q)	A summary of all spills and Unauthorized Discharges and follow up actions taken that occurred during the previous calendar year	7.0

2.0 Site Summary

Imperial Oil Resources Northwest Territories (N.W.T.) Limited (Imperial) is an upstream oil and gas facility located approximately 700 km northwest of Yellowknife, N.W.T. Operations include a central processing facility (CPF), which receives production from the mainland (along the north-eastern shore of the Mackenzie River), natural islands (Bear and Goose Island), and six artificial islands.

Imperial holds a Type A Water Licence S13L1-007 which was issued by the Sahtu Land and Water Board (SLWB) on March 5th, 2015 and is valid for 10 years. The licence serves to regulate the use of water and the deposits of waste as it relates to Imperial's site. Imperial also holds a Canada Energy Regulator (CER) Operations Authorization (OA) 1210-001 issued December 31st, 2014, also valid for 10 years. This authorization serves to regulate the oil and gas activity on Imperial's federally regulated site.

A key piece of Imperial's Norman Wells Operation (NWO) and the Type A licence is the Surveillance Network Program (SNP). The SNP is detailed in Annex A of the licence and sets out the requirements for the three branches of the SNP program including but not limited to sampling expectations, water quality release limits, and reporting. The three branches of the SNP are listed below.

- Freshwater – Mackenzie River water
- Surface Water – snow and rainwater
- Groundwater – below surface water

More information on the SNP can be found within the Water Licence S13L1-007, Annex A. All other conditions are described above in **Section 1.0**.

Operations at the Norman Wells facility temporarily ceased from July 11th 2021 and restarted on August 25th 2021. The asset was shut down to conduct maintenance activities in the central processing facility. This 1.5 month non-operating period is reflected in the data presented throughout this report.

3.0 SNP – Freshwater

The *SNP - Freshwater* covers the testing and analysis of the river water entering and leaving the central processing facility (CPF). There are two sampling locations, referred to as SNP Stations included in the SNP program. The stations are S13L1-007-1 (CPF inlet) and S13L1-007-2 (CPF outlet). The CPF inlet is the point at which the freshwater from the Mackenzie River enters the facility and the CPF outlet (or effluent) is the last point before it returns back to the Mackenzie River. This sampling is described in more detail in **Section 3.3**.

3.1 Mackenzie River Withdrawal and Return Volumes

In 2021, Imperial withdrew approximately 1.8 million cubic metres (m³) of water from the Mackenzie River (the maximum licence allowable limit is 3.5 million m³). All of this water was used for cooling in the CPF (**Figure 3-1**). Once the water was used for cooling, water was either returned to the Mackenzie River or injected to the reservoir via the freshwater injection system.

Figure 3-1: Mackenzie River Water Uses

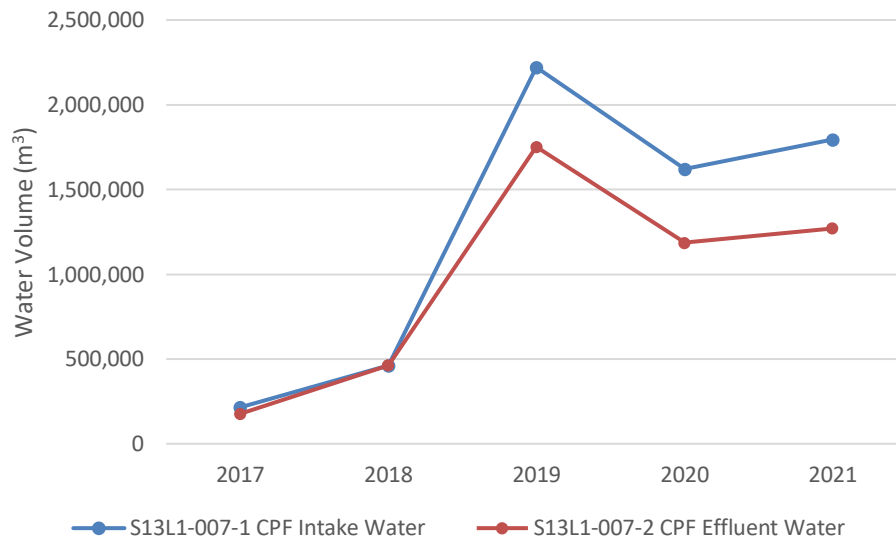


Details on the monthly quantities of freshwater withdrawn and discharged to the Mackenzie River can be found below in **Table 3-1**. All injection volumes can be found in **Table 4-1**. **Figure 3-2** shows the volume of water withdrawn from and returned to the Mackenzie River each year over a five year period. Freshwater intake and demand for cooling water will generally decrease over time as production volumes decrease.

Table 3-1: 2021 CPF Inlet and Outlet Volumes

Month	CPF Inlet (S13L1-007-1) (m ³)	CPF Outlet (S13L1-007-2) (m ³)
Jan	155,016	90,551
Feb	139,891	84,120
Mar	156,650	99,373
Apr	167,080	112,366
May	160,469	104,311
Jun	178,996	129,029
Jul	72,685	56,610
Aug	62,405	55,681
Sep	199,997	182,915
Oct	177,745	125,727
Nov	166,765	120,557
Dec	158,092	110,751
Total	1,795,790	1,271,990

Figure 3-2: Mackenzie River Withdrawal and Return Volumes (2017-2021)

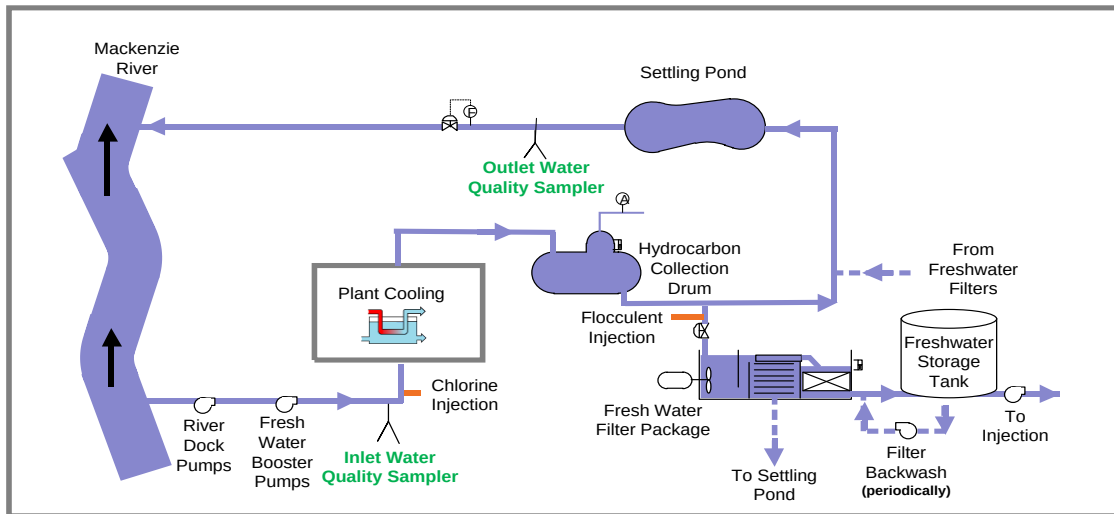


3.2 Volumes of Water Withdrawn from Other Sources

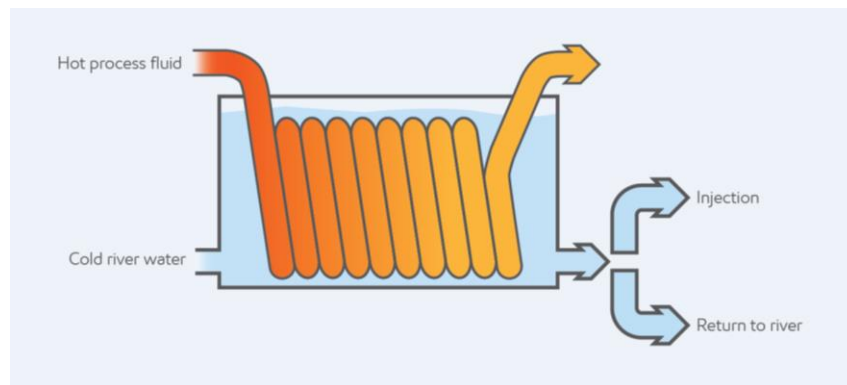
In 2021, Imperial did not withdraw any water from other sources.

3.3 Freshwater Cooling Loop Explained

As water enters the CPF facility it is tested as per licence conditions at the CPF inlet (**Figure 3-3**). After testing, chlorine is added to kill bacteria in the piping and prevent damage to the equipment. This is the same type of chlorine used to disinfect drinking water systems. In 2020, the chlorine injection was in operation periodically throughout the year (**Table A-3**). As outlined in **Section 3.1** of the *Norman Wells Quality Assurance & Quality Control Manual* (January 2018), two chemicals are added to the freshwater to reduce the amount of silt and sediment in the freshwater.

Figure 3-3: Freshwater Cooling Loop Flow Diagram

Once a water sample has been taken and chlorine is added, the water then flows through heat exchangers within the plant for the sole purposes of cooling. The Mackenzie River water does not come into contact with any process fluids during cooling. There is no chance for the water to become contaminated because the water and oil are separated by a steel barrier (**Figure 3-4**). After cooling, the water passes through the hydrocarbon collection drum. This hydrocarbon collection drum is engineer designed with sensors that can detect light hydrocarbons. It is also equipped with automatic shut in valves as a preventative measure in the unlikely event that light hydrocarbons were to be detected in the freshwater (e.g., exchanger failure).

Figure 3-4: Simple Heat Exchanger

Once the water has passed through the hydrocarbon collection drum it either goes to the field for injection into the reservoir or to the settling pond where it is returned to the Mackenzie River. As the water is released from the settling pond it is tested as per licence conditions at a testing location referred to as the CPF outlet (**Figure 3-3**).

3.4 SNP – Freshwater Data Summary

All water results are reported to the SLWB as per licence conditions in the Monthly Water Use Report and are provided annually in this report (**Appendix A**).

4.0 Freshwater and Produced Water Injection

To maintain a constant pressure in the reservoir, all volumes removed from the producing reservoir must be replaced. Pressure is maintained by injecting fluid (such as produced water or freshwater) into the reservoir through injection wells. This is referred to as a waterflood. Without water injection, the reservoir pressure would fall and production would quickly decline.

Water that is generated with the production of oil is called produced water and is re-injected into the reservoir. The volume of produced water is not enough to replace the amount of oil recovered; therefore, freshwater is used to supplement injection volumes required. The total volume of water injected in 2021 was approximately 2.3 million m³ and was made up of freshwater and produced water (**Table 4-1**)

Table 4-1: 2021 Freshwater and Produced Water Injection Volumes

Month	Freshwater Injection (m ³)	Produced Water Injection (m ³)	Total Water Injection (m ³)
Jan	64,465	162,107	226,572
Feb	55,771	150,660	206,431
Mar	57,278	175,635	232,912
Apr	54,714	180,701	235,416
May	56,158	182,421	238,579
Jun	49,967	177,431	227,398
Jul	16,076	51,313	67,389
Aug	6,720	35,872	42,591
Sep	17,082	175,503	192,585
Oct	52,017	168,119	220,137
Nov	46,207	165,225	211,432
Dec	47,340	170,905	218,245
Total	523,796	1,795,890	2,319,686

As waterfloods mature, the produced water to oil ratio from the wells typically increase resulting in increased produced water volumes with time. As a result, an increasing trend of produced water injection is observed. This is shown in **Figure 4-1**. During the fourth quarter of 2021, a trial to commingle make-up freshwater with produced water was started at the GIT-4 facility. The commingled water volumes were supplied to Bear Island, Island 5 and Island 6 water injectors. Objective of this project was to aid in better management of the overall reservoir pressure and voidage replacement. The trial is ongoing at the time this report is written.

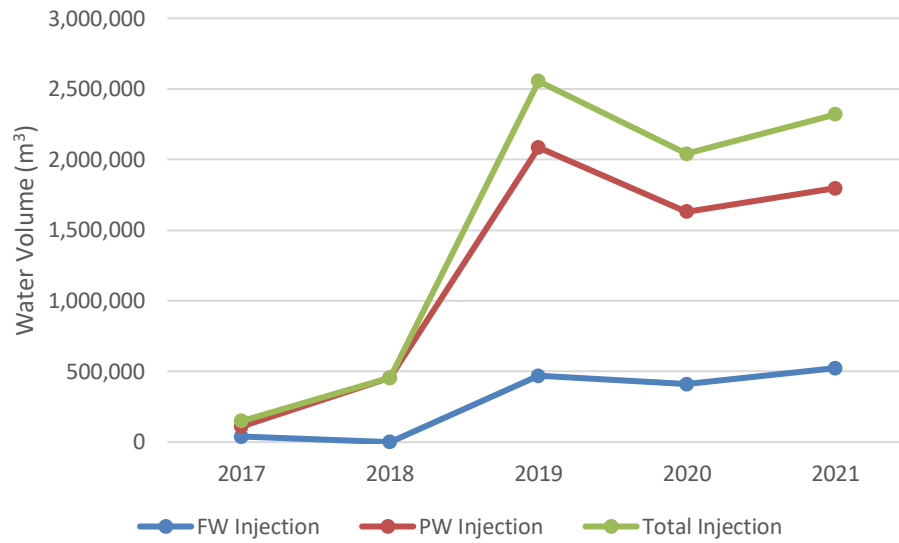


Figure 4-1: Freshwater and Produced Water Injection Volumes (2017-2021)

5.0 SNP – Surface Water

The *SNP - Surface Water* covers the testing and analysis of surface water run-off facilities. The major elements of the program include:

- collecting representative samples from surface water runoff facilities for field testing and/or laboratory analysis; and,
- performing controlled releases of surface water from runoff facilities that meets the guidelines in the Water Licence.

5.1 Surface Water Runoff Facilities (SWROF) Release Volumes

In 2021, 38,469 m³ of surface water was released back to the environment in total. This includes 2,308 m³ of Category A surface water and 36,161 m³ of Category B surface water. Category A surface water as defined within the Type A Water Licence S13L1-007 includes surface water collected from excavations in areas where there are no known historical impacts, bunkers, bermed areas and ditches where contamination is not suspected. These areas are shown below under the columns Mainland/Bear/Goose and D-42 Impound Basin (**Table 5-1**). Category B surface water includes sources where contamination may be suspected and therefore additional testing is completed prior to discharging as discussed below in Section 5.2. Category B surface water locations are shown below under the columns CPF Impound Basin, LT 11 Impound Basin, Refinery Impound Basin and Refinery Waterflood Basin (**Table 5-1**).

Table 5-1: 2021 SWROF Release Volumes

Month	CPF Impound Basin	Mainland / Bear / Goose	LT 11 Impound Basin	D-42 Impound Basin	Refinery Impound Basin	Refinery Waterflood Basin
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0
May	1,900	1,284	750	558	15,700	0
Jun	1,600	466	62	0	7,500	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	237	0
Sep	6,578	0	0	0	1,834	0
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Total	10,078	1,750	812	558	25,271	0

5.2 SNP – Surface Water Data Summary

All analytical water results (Cat A and Cat B surface water) are reported to the SLWB as per licence conditions in the Monthly Water Use Report and are provided annually in this report (**Appendix B**). In 2021 there was one occurrence where elevated pH levels were observed within the Refinery Impound Basin Surface Water Run-off Facility, where pH levels exceeded the S13L1-007 Water Licence Release Criteria for Category B surface water as outlined in Annex A: E 1b (pH 6-9). The first exceedance was observed on an August 3rd, 2021 sample of 9.18. The last water release from this surface water retention area occurred

on August 2nd (237 m³). Upon discovery of the exceedance notification was provided to CIRNAC, discharge from the basin stopped and an investigation commenced to determine the cause of the elevated pH. The investigation identified two possible causes of the pH increase:

1. Vegetation growth: higher temperatures, low rainfall, combined with low water levels within the basin (due to Operator pumping) resulted in observations of increased vegetation and algae growth within the basin. Increased growth results in a consumption of CO₂ in the water, leading to an increase in pH. Vegetation growth within the refinery impound basin is shown below (**Figure 5-1**).



Figure 5-1: Refinery Impound Basin Vegetation Growth August 2021

2. Limestone rock road maintenance activity: on an as-needed basis, the operation completes roadway maintenance work. This often involves the placement of fill material (either shale or limestone rock) sources from the Norman Wells quarry. Road maintenance (including placement of limestone rock fill) was recently completed in the vicinity of the basin prior to the August 3rd, 2021 pH exceedance.

It was concluded that increased vegetation growth was the likely reason for the pH increase. As a result, aeration of the pond was initiated on August 27th, 2021 as a means to circulate water and reintroduce CO₂ from the air to effectively lower the pH. This approach proved to be effective as the pH dropped below 9.0 on August 30th and remained within the water licence criteria (6.0-9.0) moving forward. Approval from CIRNAC was obtained on September 10th, 2021 to resume discharging of the Refinery Impound Basin after demonstrating that the pH was effectively lowered. All of the referenced analytical data above can be found in **Table B-2 of Appendix B**.

Aside from the elevated pH levels in the Refinery Impound Basin Surface Water Run-off Facility described above, there were no other exceedances of water quality criteria or uncontrolled releases in 2021.

6.0 SNP - Groundwater

The 2021 *SNP Groundwater Monitoring Program* results can be found in **Appendix C**. A summary of the results is included below.

The SNP network at Norman Wells consists of 15 groundwater monitoring wells including 2 contingency wells. There are also 3 inactive wells well that have been damaged historically and are replaced however historical data continues to be reported. A summary of the existing SNP network is shown below in **Table 6-1**.

Table 6-1: 2021 SNP Monitoring Locations

Monitoring Well	Location	Rationale for Selection
CPF 97-7-5	Mainland West	Situated between CPF and Bosworth Creek
CPF 98-8-3	Mainland West	Situated between CPF and Mackenzie River
WSY 97-1-5	Mainland East	Situated between Well Services Yard and Bosworth Creek
ARB-12-3-3	Mainland East	Adjacent Biocell 1
C38 08-1-4	Mainland East	Situated between known historical well issues (C-36x) and Mackenzie River
TF 03-12-3	Mainland East	Situated between Tank Farm and Mackenzie River; downgradient of known hydrocarbon source
MTF 97-1-5	Mainland East	Situated between Tank Farm and Town of Norman Wells
BIS 97-1-3	Bear Island	Situated between Bear Island Sump #5 and the Mackenzie River
BI-13-3-4.5	Bear Island	Situated near Bear Island Sump #6 and the Mackenzie River
BIBG-20-01-4	Bear Island	Situated at western edge of development on Bear Island, near Mackenzie River
GIBG-10-2-3	Goose Island	Situated between well pads and Mackenzie River
GIQ8-10-2-4	Goose Island	Situated between fuel storage/handling area and the Mackenzie River
GIP11 09-1-4-R	Goose Island	Situated between a sump and the Mackenzie River
Contingency Wells*		
MEBG-10-1-3	Mainland East	Situated between Mainland Sumps and Mackenzie River
BI-13-1-4	Bear Island	Situated near Bear Island Sump #6 and the Mackenzie River
Inactive Wells**		
GIP11 09-1-4	Goose Island	Situated between a sump and the Mackenzie River – well was abandoned in 2018 and reinstalled as GIP11 09-1-4-R
BIBG-10-1-4	Bear Island	Situated at western edge of Bear Island, south of the Mackenzie River – meant to replace damaged SNP well BIBG-12-1-7 – noted damaged in 2020 replaced by BIBG-20-01-4
BIBG-12-1-7	Bear Island	Situated at western edge of development on Bear Island, near Mackenzie River – well was replaced by BIBG-20-1-4 in fall 2020

*Wells serve as contingency monitoring locations in the event that a sample cannot be collected from all primary SNP locations.

** Wells that have been damaged and are replaced but historical data are reported

Two wells within the existing SNP network were observed to be damaged in 2021 by ice (BIBG-20-01-4 and GIP11 09-1-4-R) and planning is underway to replace these locations or utilize suitable adjacent locations of existing monitoring wells to maintain coverage of the network in 2022.

The 2021 groundwater results were analyzed as outlined in the Norman Wells Operation Groundwater Management Plan (dated September 2015). No anomalous chemistry, upward trend, or CCME FWAL guideline exceedances were identified that require additional follow-up at this time. Imperial will continue to execute the *SNP Groundwater Monitoring Program* and analyze the data annually.

7.0 Reportable Releases

Imperial reported all 2021 government reportable releases to the CER Online Event Reporting System and the Northwest Territories – Nunavut (NT - NU) Spill Report Line.

7.1 Incident Prevention and Reduction

Imperial's integrity and reliability processes utilize a structured approach of prevention, detection, response and recovery. A variety of activities related to release prevention, reduction, mitigation, response and training is undertaken annually. These activities are designed to eliminate potential releases, detect releases should they occur and if they do occur, ensure an effective and timely clean up. Key elements for achieving this strategy include:

- awareness training for employees and contractors
- pre-job preparation and hazard recognition
- surveillance and monitoring
- flowline leak detection
- routine integrity testing and maintenance
- regularly scheduled emergency response training and exercises and;
- incident reporting processes; management support for a strong incident reporting culture
- analysis of incident trending to evaluate and understand learnings to improve future performance

For any new workers to site (both employees and contractors) a safety and environmental training package is reviewed covering environmental topics such as release prevention, reporting, waste management, and wildlife. Other tools such as Environmental Alerts, a one page bulletin intended as a high level overview of key topics, may be used to communicate to workers specific environmental information on an as needed basis. Environmental incidents and associated learnings are reviewed real-time with the general workforce in daily operations and stewardship meetings.

7.2 Spill Summary

In 2021, Imperial reported two government reportable release events to the CER's Online Event Reporting System (OERS) and the Northwest Territories – Nunavut (NT-NU) Spill Report Line (**Table 7-1**).

Each event was reported on and responded to immediately. Incident investigation details and clean up statuses are provided to the CER through the Monthly Release Report and the OERS, and to the SLWB via a Supplemental Release Report (30 Day Report). Clean-up activities have been completed for all 2021 releases (including non-government reportable) and the incident investigations have been closed.

Further environmental assessments were completed in 2021 focusing on two previous government reported releases in 2020 (INC2020-080/NT-NU #20-248 and INC2020-071/REM2020-026/NT-NU #20-216). An updated annual report for REM2020-026 will be submitted separately to the CER via the OERS and SLWB by March 31, 2022 including assessment results from 2021 and proposed next steps. An update on INC2020-080 including the results from a soil assessment program, development of a site specific remedial objective for surficial nitrate and proposed next steps including a surficial excavation to recover remaining nitrate impacts in June 2022 will be included in the upcoming submission of the annual Closure & Reclamation report in May 2022 as previously discussed with the CER and SLWB.

Table 7-1: Details on 2021 NT-NU Reportable Releases

Date Occurred	CER INC Number	NT/NU Spill Number	Location of Incident	Product Released	Volume Released	Volume Contained	Volume Reaching the Environment	Executive Summary	Direct Cause	Status of Clean Up
03/19/2021	INC20 21-046	2021-105	Central Processing Facility	Natural Gas	56,000 m ³	0 m ³	56,000 m ³	While completing rounds within the central processing facility, an operator discovered excess blanket gas venting from a tank pressure vacuum relief device. Upon identification, immediate action was taken to stop the release (isolate the source). Technical engineering support concluded total amount of natural gas released to the environment during the incident was 56,000 m ³ . The root cause of the release was determined to be a failed blanket gas regulator (equipment malfunction).	Equipment – Other Malfunctioned / Did Not Function	Complete
10/07/2021	INC20 21-150	2021-435	Mainland E-35x	Crude Oil	1.5 m ³	0 m ³	1.5 m ³	E-35 surface casing vent (SCV) pipe discovered to be failed at threaded connection to wellhead during well abandonment activities. Investigation determined ~ 1- 1.5 m ³ of crude oil would have been released to the Mackenzie River during spring break up in 2020 and 2021 while bunker well was overtopped with water. SCV pipe was repaired, and well has been fully abandoned downhole. Investigation found 3 root causes including; E-35's SCV piping was found to be unsupported, leading to excess stress and failure at the threaded connection to the SCV head tie-in at the well causing the release. Bunker well cleaning procedures were not being followed causing excess build-up of sediment and sand under the floor grating preventing observation of the SCV piping during routine maintenance and surveillance. Surveillance of the annual SCV tote volumes collected at E-35 was not assigned. Individual previously responsible was released from company in December 2020 and handover of surveillance duties was inadequate therefore the drop in volumes collected in 2020 and 2021 went undetected.	Equipment – Other Mechanical Integrity	Complete

8.0 Drilling Activity Summary

There was no drilling activity in 2021 nor are there plans to drill in 2022. All drilling sumps have been capped and are in the remediation process. There were no drilling fluid releases in 2021.

9.0 Waste

Waste generated on site is collected and disposed of at appropriate waste facilities both on and off site in accordance with the operating approval conditions for Imperial's Onsite Hazardous Waste Storage Yard, Generator Number NTG339, Receiver Number NTR019. In 2021, approximately 51 tonnes of hazardous waste and 96 tonnes of non-hazardous waste were transported to approved facilities outside of Norman Wells including Yellowknife and Northern Alberta (High Level, Ryley and Rainbow Lake).

Two Imperial owned soil treatment facilities (bio cells) continue to operate, treating impacted material for reuse on site. Additional sampling and surveying of the stockpiles was completed in 2021 to fully characterize material within the two bio cells. At the end of 2021, a total of approximately 2200 m³ impacted soil was stockpiled within the bio cell footprints with no material removal from the biocell occurring in 2021.

An active *Waste Management Plan* serves as a resource document and field guide for waste management on-site, and includes additional details about the bio cell and other waste facilities at the NWO. As updates to this plan are made, the plan is filed with the SLWB.

10.0 Emergency Response

Imperial's Emergency Response Plan (ERP) includes set objectives for responding to emergencies in an effective and timely manner. These objectives include the following:

- manage risks, inherent in all operations to minimize releases;
- ensure that all employees understand their responsibility as it relates to emergencies and preventing them from occurring;
- develop and maintain emergency response capabilities locally and have the ability to quickly expand and leverage other resources; and,
- initiate appropriate response measures immediately and take all reasonable measures to ensure the safety of our workforce and the public and for the protection of the community and the environment.

In addition to the ERP mentioned above, a Spill Contingency and Response Plan (SCARP) also exists as a supplement the ERP. The SCARP is a more detailed field level strategy guide. Copies of both the ERP and SCARP are filed with the SLWB and CER and other agencies as appropriate.

The local Norman Wells workforce, in the event of an emergency, would be known as the emergency response team (ERT). The ERT completes regular training on roles and responsibilities, the structure and organization of the incident command system, emergency response equipment, as well as various response techniques (e.g., boom deployment and oil recovery on water). Within the scope of any training, the objectives of the exercise, learnings and any improvement areas are discussed throughout and followed up as required.

A summary of the exercises completed in 2021 is included in **Table 10-1**.

Table 10-1: 2021 Emergency Response Exercises

Date	Description
5-Mar-21	Brittle Fracture leading to a gas release (H ₂ S, Hydrocarbon)
5-Mar-21	Blocked Flare
28-Mar-21	Confined Space (Mandown)
4-Apr-21	Confined Space (Mandown)
27-May-21	Helicopter Overdue
23-Aug-21	Crude Oil Pool Fire
26-Aug-21	Office Fire Drill
26-Aug-21	Old Compressor Building VCE Evacuation Drill
1-Sep-21	Marine Transport Incident
27-Sep-21	Old Compressor Building VCE Evacuation Drill
19-Oct-21	Turbine Generator Fire & Mandown
31-Oct-21	Old Compressor Building VCE Evacuation Drill
21-Nov-21	Mandown Helicopter Rescue
26-Nov-21	Chlorine Release & Mandown Confined Space Rescue
29-Nov-21	Old Compressor Building VCE Evacuation Drill
8-Dec-21	BCP exercise – Forest Fire Disrupting Access to Site
14-Dec-21	Ice Road Construction / Transport Incident

A summary of the exercises planned for 2022 is included in **Table 10-2**.

Table 10-2: 2022 Planned Emergency Response Exercises

Date	Description
Feb	Propane release – E2 scenario, Explosion of V-117 Propane Reflux Drum - BLEVE
Feb	TG Building Fire – CO ₂ fire suppression system activated
Mar	Brittle Fracture
Apr	Business Continuity Plan Exercise
Apr	Helicopter Overdue
May	Security Threat – Bomb / Intruder / Suspicious Package
May	Old Compressor Building VCE Evacuation Drill
June	Old Compressor Building VCE Evacuation Drill
June	Man Down – Confined Space Rescue (Illness, Injury or Fatality)
July	Marine Transport Incident
July	Old Compressor Building VCE Evacuation Drill
July/Aug	Marine Response Drills (Man Overboard, Fire on Ship, etc.)
July/Aug	Field Response Drills (boom deployment, skimmer operations, etc.)
Aug	Old Compressor Building VCE Evacuation Drill
Aug	E2 Petroleum Crude Oil – Release of TK-119

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Sept	Blocked Flare
Sept	Well Blowout
Oct	E2 Chlorine release – release of one-ton cylinder
Nov	Ice Road Incident

11.0 Work Summary

Below is a list of modification(s) and maintenance work carried out as per Part G of the licence in 2021:

- Mainland dock maintenance dredging modification request to improve access for vessel traffic including emergency response boats. (Board approval received on November 24, 2020). Amendment to Part F of S13L1-007 to include “operations and maintenance dredging activities”. Dredging work did not proceed as planned in the 2021 winter due to large ice cover around the mainland dock, therefore no quantities of water used and sediment dredged from the river is being reported.
- Bosworth Creek Utilidor and Flowline Rerouting due to natural sloughing observed along the east bank of Bosworth Creek, north of the Lower Bosworth Bridge (Modification request submitted on June 17, 2021)

Acronyms

Acronym	Definition
AEMP	Aquatic Effects Monitoring Program
BPT	Bear Island Pipeline Terminal
BLEVE	Boiling Liquid Expanding Vapor Explosion
CCME	Canadian Council of Ministers of the Environment
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CER	Canada Energy Regulator
CPF	central processing facility
EC	specific conductivity
ERP	Emergency Response Plan
ERS	Event Reporting System
ERT	emergency response team
FWAL	Freshwater Aquatic Life
Imperial	Imperial Oil Resources N.W.T. Limited
L	litres
m ³	cubic metres
mg/l	milligrams per litre
n/a	Not applicable
NWO	Norman Wells Operations
N.W.T.	Northwest Territories
NT-NU	Northwest Territories – Nunavut
OA	Operations Authorization
OERS	Online Event Reporting System
SCARP	Spill Contingency and Response Plan
SLWB	Sahtu Land and Water Board
SNP	Surveillance Network Program
SWROF	Surface water runoff facilities
TPH	Total Petroleum Hydrocarbons
TSS	total suspended solids
uS/cm	micro Siemens per centimetre

12.0 Glossary

Term	Description
Acute lethality	An effluent is deemed acutely lethal if the undiluted (100%) effluent kills 50% or more of the fish or <i>Daphnia magna</i> in the test. Biological test method: Acute Lethality Test Using Rainbow Trout Report EPS 1/RM/9 July 1990 (with May 1996 and May 2007 amendments) and Acute Lethality of Effluents to <i>Daphnia magna</i> EPS 1/RM/14 Second Edition December 2000, or as may be amended from time to time.
Average concentration	The running average of any four consecutive analytical results submitted to the Board in accordance with the sampling and analysis requirements specified in the "Surveillance Network Program".
Bathymetric survey	A survey used to measure the topography on the bottom of a waterbody. Imperial conducts these surveys on the Mackenzie River to help identify and understand what changes have occurred on the river bottom.
Central processing facility (CPF)	The plant where oil, gas, and produced water, are collected from the oilfield and separated.
Exceedance	Results are above the maximum concentrations listed in Water Licence S13L1-007
Flowline	A line that is used to transport fluids from a well to a production facility or vice versa, and includes intrafield export and all gathering lines
Phenols	Any of a family of organic compounds characterized by a hydroxyl (-OH) group attached to a carbon atom that is part of an aromatic ring. Phenols are widely used in household products such as cleaners and mouthwash. They are commonly found in nature and can be obtained from essential oils of plants. Phenols can also be obtained from the distillation of coal tar or crude petroleum. (Source: www.britannica.com).
Produced water	Water extracted from the reservoir as a mixture with oil and gas
SNP Station S13L1-007-1	The Surveillance Network Station for the CPF intake water.
SNP Station S13L1-007-2	The Surveillance Network Station for the CPF cooling flow return.
Surface water run-off facilities	The Refinery Impounding basin, Battery 3 impounding basin (also known as LT 11), Refinery waterflood Basin, CPF impounding area (also known as LT 2), miscellaneous Mainland impounding areas, miscellaneous Bear Island impounding areas, miscellaneous Goose Island impounding areas, and associated ditches provided for the collection, storage, and discharge of surface run-off waters from the NWO.
Surveillance network program	A network of devices or sampling points designed to test environmental conditions for comparison against baseline data obtained from a point or area designated as a control. This is a method of tracking and identifying the spread of deleterious substances in the environment.
Waste	Waste as defined by Section 2 of the <i>Northwest Territories Waters Act</i>
Waterflood	The injections of water into the Norman Wells oilfield reservoir for pressure maintenance and enhanced oil production
Water intake	The wetwell pump and associated facilities installed in the Mackenzie River and the water line to the CPF

Appendix A CPF Inlet and Outlet Water Data

Table A-1: Total Petroleum Hydrocarbons and Phenols

	CPF Inlet Total Petroleum Hydrocarbons (mg/L)	CPF Inlet Phenols (mg/L)	CPF Outlet Total Petroleum Hydrocarbons (mg/L)	CPF Outlet Phenols (mg/L)
SNP Station	S13L1-007-1	S13L1-007-1	S13L1-007-2	S13L1-007-2
Water Licence Criteria	n/a	n/a	5.0 mg/L	0.14mg/L
4-Jan	<2.0	<0.0015	<2.0	<0.0015
11-Jan	<2.0	<0.0015	<2.0	0.0016
18-Jan	<2.0	<0.0015	<2.0	<0.0015
25-Jan	<2.0	<0.0015	<2.0	<0.0015
1-Feb	<2.0	<0.0015	<2.0	<0.0015
8-Feb	<2.0	<0.0015	<2.0	<0.0015
15-Feb	<2.0	<0.0015	<2.0	<0.0015
23-Feb	<2.0	<0.0015	<2.0	<0.0015
1-Mar	<2.0	<0.0015	<2.0	<0.0015
8-Mar	<2.0	<0.0015	<2.0	<0.0015
15-Mar	<2.0	<0.0015	<2.0	<0.0015
22-Mar	<2.0	<0.0015	<2.0	<0.0015
29-Mar	<2.0	<0.0015	<2.0	<0.0015
5-Apr	<2.0	0.0021	<2.0	<0.0015
12-Apr	<2.0	<0.0015	<2.0	<0.0015
19-Apr	<2.0	<0.0015	<2.0	<0.0015
26-Apr	<2.0	<0.0015	<2.0	<0.0015
3-May	<2.0	<0.0015	<2.0	<0.0015
6-May	<2.0	<0.0015	<2.0	<0.0015
10-May	<2.0	<0.0015	<2.0	<0.0015
17-May	<2.0	<0.0015	<2.0	0.0019
20-May	<2.0	0.0021	<2.0	0.0025
24-May	<2.0	<0.0015	<2.0	0.002
27-May	<2.0	0.0015	<2.0	0.0025
31-May	<2.0	<0.0015	<2.0	0.0017
3-Jun	<2.0	<0.0015	<2.0	<0.0015
7-Jun	<2.0	<0.0015	<2.0	<0.0015
14-Jun	<2.0	<0.0015	<2.0	<0.0015
22-Jun	<2.0	<0.0015	<2.0	<0.0015
28-Jun	<2.0	<0.0015	<2.0	<0.0015

	CPF Inlet Total Petroleum Hydrocarbons (mg/L)	CPF Inlet Phenols (mg/L)	CPF Outlet Total Petroleum Hydrocarbons (mg/L)	CPF Outlet Phenols (mg/L)
SNP Station	S13L1-007-1	S13L1-007-1	S13L1-007-2	S13L1-007-2
Water Licence Criteria	n/a	n/a	5.0 mg/L	0.14mg/L
5-Jul	<2.0	<0.0015	<2.0	<0.0015
12-Jul	<2.0	<0.0015	<2.0	<0.0015
19-Jul	*	*	*	*
26-Jul	*	*	*	*
2-Aug	*	*	*	*
9-Aug	*	*	*	*
16-Aug	*	*	*	*
24-Aug	<2.0	<0.0015	<2.0	<0.0015
27-Aug	<2.0	<0.0015	<2.0	<0.0015
30-Aug	<2.0	<0.0015	<2.0	<0.0015
7-Sep	<2.0	<0.0015	<2.0	<0.0015
13-Sep	<2.0	<0.0015	<2.0	0.0016
20-Sep	<2.0	<0.0015	<2.0	<0.0015
27-Sep	<2.0	<0.0015	<2.0	<0.0015
5-Oct	<2.0	<0.0015	<2.0	<0.0015
12-Oct	<2.0	<0.0015	<2.0	0.0021
18-Oct	<2.0	<0.0015	<2.0	0.0023
25-Oct	<2.0	<0.0015	<2.0	<0.0015
1-Nov	<2.0	0.0023	<2.0	0.0019
8-Nov	<2.0	<0.0015	<2.0	<0.0015
15-Nov	<2.0	<0.0015	<2.0	<0.0015
22-Nov	<2.0	0.0017	<2.0	<0.0015
29-Nov	<2.0	<0.0015	<2.0	<0.0015
6-Dec	<2.0	<0.0015	<2.0	<0.0015
13-Dec	<2.0	<0.0015	<2.0	<0.0015
20-Dec	<2.0	<0.0015	<2.0	<0.0015
28-Dec	<2.0	<0.0015	<2.0	0.0023

*Norman Wells facility non-operational for planned maintenance shutdown

Table A-2: Total Suspended Solids (TSS), pH and Specific Conductivity (EC)

	CPF Inlet Total TSS (mg/L)	CPF Inlet Total pH (mg/L)	CPF Inlet Total EC (mg/L)	CPF Outlet Total TSS (mg/L)	CPF Outlet Total pH (mg/L)	CPF Outlet Total EC (mg/L)
SNP Station	S13L1-007-1	S13L1-007-1	S13L1-007- 1	S13L1-007-2	S13L1-007-2	S13L1- 007-2
Water Licence Criteria	n/a	n/a	n/a	n/a	Between	n/a
					6 – 9	
3-Jan	<1.0	7.79	250	1.9	7.79	250
4-Jan	20	7.72	250	<1.0	7.86	250
7-Jan	1.7	6.7	270	2.7	6.67	250
11-Jan	<1.0	6.92	260	2.4	7.52	250
14-Jan	1.2	7.94	260	1.9	8.03	250
18-Jan	3.1	6.8	260	5.1	7.29	250
21-Jan	<1.0	8.15	250	2.7	8.02	240
25-Jan	1.1	6.59	250	2.5	7.57	250
28-Jan	3.5	8.08	260	2.9	8.26	250
1-Feb	5.8	7.27	250	1.7	7.77	240
4-Feb	6.8	8.03	250	<1.0	8.04	240
8-Feb	<1.0	7.94	240	1.8	8.1	240
11-Feb	11	7.89	240	<1.0	7.9	240
15-Feb	1.2	8.04	250	<1.0	8.08	230
18-Feb	5.6	8.14	240	1	8.18	240
23-Feb	4	7.78	240	1.9	8.02	230
25-Feb	7	7.97	250	2.7	7.82	240
1-Mar	1.5	7.73	240	1.5	7.91	230
4-Mar	1.4	7.81	240	2.9	8.04	240
8-Mar	1.3	8.13	250	<1.0	7.92	230
11-Mar	<1.0	8.17	240	1	8.07	240
15-Mar	1.2	7.78	240	<1.0	8.06	230
18-Mar	1.6	8.6	250	2	8.25	240
22-Mar	5.3	7.98	230	1.8	8	230
25-Mar	1.3	8.03	230	1.3	7.8	240
29-Mar	5.3	7.51	230	4.6	7.91	240
1-Apr	<1.0	7.92	240	1	8.09	230
5-Apr	<1.0	7.98	230	<1.0	7.97	230
8-Apr	<1.0	8.25	240	<1.0	8.17	230
12-Apr	<1.0	7.55	240	2.2	7.94	240
15-Apr	2.5	7.9	240	1.4	7.83	240

	CPF Inlet Total TSS (mg/L)	CPF Inlet Total pH (mg/L)	CPF Inlet Total EC (mg/L)	CPF Outlet Total TSS (mg/L)	CPF Outlet Total pH (mg/L)	CPF Outlet Total EC (mg/L)
SNP Station	S13L1-007-1	S13L1-007-1	S13L1-007- 1	S13L1-007-2	S13L1-007-2	S13L1- 007-2
Water Licence Criteria	n/a	n/a	n/a	n/a	Between 6 – 9	n/a
19-Apr	1.1	7.37	230	<1.0	7.86	230
22-Apr	<1.0	7.88	240	5.3	8.24	240
26-Apr	<1.0	8.06	250	<1.0	8.07	250
29-Apr	1.3	8.12	250	1.7	7.96	250
3-May	<1.0	8.08	250	<1.0	8.1	250
6-May	<1.0	8.25	270	<1.0	8.34	280
10-May	5.5	8.17	240	8.7	8.12	250
13-May	10	7.96	230	17	7.81	250
17-May	6.3	7.88	220	27	7.91	240
20-May	36	8.04	230	27	8.03	240
24-May	44	8.09	220	61	8.09	240
27-May	5.7	8.1	230	26	7.88	240
31-May	9.1	8	240	11	7.99	240
3-Jun	8	8	240	19	8	250
7-Jun	14	8	240	22	8	240
10-Jun	50	8	250	22	8	250
14-Jun	12	8	260	26	8	240
17-Jun	**	**	**	**	**	**
22-Jun	16	8	240	20	8	250
24-Jun	45	8	240	32	8	240
28-Jun	22	8	260	13	8	260
1-Jul	31	8	240	15	8	240
5-Jul	47	8	240	11	8	250
8-Jul	140	8	240	17	8	240
12-Jul	36	8	260	91	8	250
15-Jul	*	*	*	*	*	*
19-Jul	*	*	*	*	*	*
22-Jul	*	*	*	*	*	*
26-Jul	*	*	*	*	*	*
29-Jul	*	*	*	*	*	*
2-Aug	*	*	*	*	*	*
5-Aug	*	*	*	*	*	*
9-Aug	*	*	*	*	*	*
12-Aug	*	*	*	*	*	*
16-Aug	*	*	*	*	*	*

	CPF Inlet Total TSS (mg/L)	CPF Inlet Total pH (mg/L)	CPF Inlet Total EC (mg/L)	CPF Outlet Total TSS (mg/L)	CPF Outlet Total pH (mg/L)	CPF Outlet Total EC (mg/L)
SNP Station	S13L1-007-1	S13L1-007-1	S13L1-007- 1	S13L1-007-2	S13L1-007-2	S13L1- 007-2
Water Licence Criteria	n/a	n/a	n/a	n/a	Between 6 – 9	n/a
19-Aug	*	*	*	*	*	*
24-Aug	6	8	290	6	8	300
27-Aug	9	8	260	14	8	260
30-Aug	100	8	260	22	8	270
2-Sep	27	8.09	260	7.8	8	270
7-Sep	380	7.25	280	9.5	7.81	270
9-Sep	200	8.07	310	33	8.2	270
13-Sep	770	8.25	280	30	8.27	270
16-Sep	7.3	8.1	280	28	8.04	260
20-Sep	77	8.09	270	35	8.05	280
23-Sep	8.2	8.21	270	1.7	8.19	260
27-Sep	5.1	8.12	280	4.5	8.09	260
30-Sep	110	8.07	290	12	8.05	260
5-Oct	30	7.90	280	27	7.49	260
7-Oct	180	7.62	270	19	7.47	270
12-Oct	440	7.67	260	10	7.97	260
14-Oct	6	8.14	270	18	8.14	270
18-Oct	5	8.21	270	18	7.26	270
21-Oct	9	8.05	260	19	8.00	270
25-Oct	<1.0	7.79	260	15	8.02	260
28-Oct	130	8.05	270	6	7.41	260
1-Nov	79	8.04	260	7.2	7.95	260
4-Nov	130	8.2	270	6.6	8.18	270
8-Nov	300	8.07	260	12	8.01	260
11-Nov	61	8.09	260	4.7	8.12	260
15-Nov	1.4	8.15	260	1.6	8.13	270
18-Nov	24	8.06	260	5.3	8.09	260
22-Nov	44	8.22	280	5.7	8.16	270
25-Nov	77	8.04	290	7.9	8.13	280
29-Nov	200	7.86	280	6.3	8.1	280
2-Dec	3.4	7.9	280	1.5	7.94	270
6-Dec	89	8.16	290	4.5	7.88	280
10-Dec	39	8.02	280	3.4	8.13	270
13-Dec	1.7	7.71	270	3	7.91	270

	CPF Inlet Total TSS (mg/L)	CPF Inlet Total pH (mg/L)	CPF Inlet Total EC (mg/L)	CPF Outlet Total TSS (mg/L)	CPF Outlet Total pH (mg/L)	CPF Outlet Total EC (mg/L)
SNP Station	S13L1-007-1	S13L1-007-1	S13L1-007- 1	S13L1-007-2	S13L1-007-2	S13L1- 007-2
Water Licence Criteria	n/a	n/a	n/a	n/a	Between 6 – 9	n/a
17-Dec	1	7.95	260	3.5	7.91	260
20-Dec	6.2	7.84	260	2.1	7.63	260
23-Dec	3.3	7.95	260	1.9	7.98	260
28-Dec	3.3	7.56	260	<1.0	7.79	260
30-Dec	5.1	8	280	4.2	8.05	260

*Norman Wells facility non-operational for planned maintenance shutdown

** Sample unable to be analyzed due to logistical transport issue

Table A-3: Average Daily Chlorine and Temperature

	Daily Chlorine (mg/L)	CPF Outlet Temperature (°C)
SNP Station	S13L1-007-2	
Water Licence Criteria	n/a	n/a
1-Jan	0.01	5.8
2-Jan	0.01	5.3
3-Jan	0.01	5.7
4-Jan	0.01	5.2
5-Jan	0.01	6.3
6-Jan	0.02	6.7
7-Jan	0.01	7.6
8-Jan	0.01	7.9
9-Jan	0	8.1
10-Jan	0.03	7.7
11-Jan	0.01	7.7
12-Jan	0.01	7.1
13-Jan	0.01	6.7
14-Jan	0.04	7.1
15-Jan	0	7.1
16-Jan	0	7.1
17-Jan	0	6.7
18-Jan	0.01	6.5
19-Jan	0	6.1
20-Jan	0.03	6.8
21-Jan	0.02	8.3
22-Jan	0.01	7.1
23-Jan	0.01	6.0
24-Jan	0.01	6.7
25-Jan	0.01	6.5
26-Jan	0.01	6.2
27-Jan	0.01	5.7
28-Jan	0.01	5.9
29-Jan	0.01	5.9
30-Jan	0.01	7.3
31-Jan	0	7.4
1-Feb	0.01	5.4
2-Feb	0.02	5.4
3-Feb	0.01	4.9
4-Feb	0.01	5.2
5-Feb	0.02	5.1

	Daily Chlorine (mg/L)	CPF Outlet Temperature (°C)
SNP Station	S13L1-007-2	
Water Licence Criteria	n/a	n/a
6-Feb	0.02	5.8
7-Feb	0.02	5.5
8-Feb	0.01	4.9
9-Feb	0.00	5.2
10-Feb	0.00	5.8
11-Feb	0.00	6.6
12-Feb	0.00	7.2
13-Feb	0.00	6.6
14-Feb	0.00	7.0
15-Feb	0.00	7.7
16-Feb	0.00	8.2
17-Feb	0.00	5.6
18-Feb	0.00	5.8
19-Feb	0.00	4.9
20-Feb	0.00	6.2
21-Feb	0.00	6.6
22-Feb	0.00	7.3
23-Feb	0.00	7.7
24-Feb	0.00	7.6
25-Feb	0.00	7.0
26-Feb	0.01	6.0
27-Feb	0.00	5.2
28-Feb	0.00	4.1
1-Mar	0.00	4.7
2-Mar	0.00	5.8
3-Mar	0.00	6.7
4-Mar	0.00	6.8
5-Mar	0.00	7.6
6-Mar	0.00	7.3
7-Mar	0.00	6.5
8-Mar	0.00	7.3
9-Mar	0.00	8.2
10-Mar	0.00	8.5
11-Mar	0.00	6.4
12-Mar	0.00	5.2
13-Mar	0.00	7.8
14-Mar	0.00	7.5

	Daily Chlorine (mg/L)	CPF Outlet Temperature (°C)
SNP Station	S13L1-007-2	
Water Licence Criteria	n/a	n/a
15-Mar	0.00	7.9
16-Mar	0.05	8.4
17-Mar	0.04	8.4
18-Mar	0.03	8.8
19-Mar	0.02	7.0
20-Mar	0.00	6.4
21-Mar	0.01	7.3
22-Mar	0.00	6.4
23-Mar	0.01	5.9
24-Mar	0.00	7.7
25-Mar	0.00	9.2
26-Mar	0.00	9.1
27-Mar	0.00	7.3
28-Mar	0.00	6.2
29-Mar	0.00	7.7
30-Mar	0.02	8.6
31-Mar	0.02	10.0
1-Apr	0.01	8.0
2-Apr	0.02	9.3
3-Apr	0.02	9.5
4-Apr	0.01	9.9
5-Apr	0.00	8.4
6-Apr	0.01	9.0
7-Apr	0.02	8.3
8-Apr	0.01	8.9
9-Apr	0.00	7.0
10-Apr	0.00	7.0
11-Apr	0.00	8.4
12-Apr	0.00	10.1
13-Apr	0.00	11.7
14-Apr	0.00	12.6
15-Apr	0.00	14.6
16-Apr	0.00	15.2
17-Apr	0.00	13.1
18-Apr	0.01	12.5
19-Apr	0.00	12.2
20-Apr	0.00	10.2

	Daily Chlorine (mg/L)	CPF Outlet Temperature (°C)
SNP Station	S13L1-007-2	
Water Licence Criteria	n/a	n/a
21-Apr	0.01	9.3
22-Apr	0.01	9.5
23-Apr	0.01	10.9
24-Apr	0.00	11.5
25-Apr	0.00	11.1
26-Apr	0.00	10.6
27-Apr	0.00	11.1
28-Apr	0.01	11.6
29-Apr	0.00	12.4
30-Apr	0.00	13.0
1-May	0.00	13.2
2-May	0.00	14.5
3-May	0.01	14.5
4-May	0.01	15.1
5-May	0.00	15.6
6-May	0.00	16.5
7-May	0.00	15.8
8-May	0.00	15.9
9-May	0.00	14.3
10-May	0.01	14.4
11-May	0.02	15.7
12-May	0.02	14.6
13-May	0.01	13.9
14-May	0.02	13.7
15-May	0.01	14.2
16-May	0.01	13.9
17-May	0.01	13.7
18-May	0.02	12.9
19-May	0.01	12.9
20-May	0.00	13.0
21-May	0.00	13.9
22-May	0.00	14.0
23-May	0.00	13.5
24-May	0.01	14.6
25-May	0.01	14.6
26-May	0.02	15.2
27-May	0.00	14.8

	Daily Chlorine (mg/L)	CPF Outlet Temperature (°C)
SNP Station	S13L1-007-2	
Water Licence Criteria	n/a	n/a
28-May	0.00	14.0
29-May	0.00	14.7
30-May	0.00	17.1
31-May	0.00	19.7
1-Jun	0.00	18.4
2-Jun	0.00	19.9
3-Jun	0.00	20.3
4-Jun	0.00	20.3
5-Jun	0.00	19.5
6-Jun	0.00	20.4
7-Jun	0.00	21.0
8-Jun	0.00	21.4
9-Jun	0.00	21.9
10-Jun	0.00	21.8
11-Jun	0.00	21.2
12-Jun	0.00	20.1
13-Jun	0.00	19.5
14-Jun	0.00	19.9
15-Jun	0.00	21.0
16-Jun	0.00	21.6
17-Jun	0.00	22.4
18-Jun	0.00	22.7
19-Jun	0.00	21.7
20-Jun	0.00	22.1
21-Jun	0.00	20.5
22-Jun	0.00	20.4
23-Jun	0.00	23.2
24-Jun	0.00	24.4
25-Jun	0.00	24.2
26-Jun	0.00	24.1
27-Jun	0.00	23.7
28-Jun	0.00	25.0
29-Jun	0.00	24.7
30-Jun	0.00	23.3
1-Jul	0.00	24.7
2-Jul	0.00	25.2
3-Jul	0.00	24.5

	Daily Chlorine (mg/L)	CPF Outlet Temperature (°C)
SNP Station	S13L1-007-2	
Water Licence Criteria	n/a	n/a
4-Jul	0.00	24.1
5-Jul	0.00	24.3
6-Jul	0.00	24.6
7-Jul	0.00	23.5
8-Jul	0.00	24.6
9-Jul	0.00	24.7
10-Jul	0.00	24.7
11-Jul	0.00	22.6
12-Jul	*	*
13-Jul	*	*
14-Jul	*	*
15-Jul	*	*
16-Jul	*	*
17-Jul	*	*
18-Jul	*	*
19-Jul	*	*
20-Jul	*	*
21-Jul	*	*
22-Jul	*	*
23-Jul	*	*
24-Jul	*	*
25-Jul	*	*
26-Jul	*	*
27-Jul	*	*
28-Jul	*	*
29-Jul	*	*
30-Jul	*	*
31-Jul	*	*
1-Aug	*	*
2-Aug	*	*
3-Aug	*	*
4-Aug	*	*
5-Aug	*	*
6-Aug	*	*
7-Aug	*	*
8-Aug	*	*
9-Aug	*	*

	Daily Chlorine (mg/L)	CPF Outlet Temperature (°C)
SNP Station	S13L1-007-2	
Water Licence Criteria	n/a	n/a
10-Aug	*	*
11-Aug	*	*
12-Aug	*	*
13-Aug	*	*
14-Aug	*	*
15-Aug	*	*
16-Aug	*	*
17-Aug	*	*
18-Aug	*	*
19-Aug	*	*
20-Aug	*	*
21-Aug	*	*
22-Aug	0.00	16.4
23-Aug	0.00	15.8
24-Aug	0.00	16.9
25-Aug	0.00	18.3
26-Aug	0.00	19.5
27-Aug	0.00	21.7
28-Aug	0.00	21.1
29-Aug	0.00	20.3
30-Aug	0.00	21.3
31-Aug	0.00	21.7
1-Sep	0.00	22.0
2-Sep	0.00	22.7
3-Sep	0.00	23.0
4-Sep	0.00	23.2
5-Sep	0.00	23.3
6-Sep	0.00	22.5
7-Sep	0.00	21.0
8-Sep	0.00	18.1
9-Sep	0.00	16.9
10-Sep	0.00	16.2
11-Sep	0.00	15.8
12-Sep	0.00	15.7
13-Sep	0.00	15.6
14-Sep	0.00	15.3
15-Sep	0.00	15.1

	Daily Chlorine (mg/L)	CPF Outlet Temperature (°C)
SNP Station	S13L1-007-2	
Water Licence Criteria	n/a	n/a
16-Sep	0.00	20.8
17-Sep	0.00	20.4
18-Sep	0.00	20.0
19-Sep	0.00	20.1
20-Sep	0.00	19.1
21-Sep	0.00	19.1
22-Sep	0.00	16.2
23-Sep	0.00	15.7
24-Sep	0.02	15.4
25-Sep	0.00	14.0
26-Sep	0.01	14.5
27-Sep	0.01	15.4
28-Sep	0.02	14.3
29-Sep	0.04	14.7
30-Sep	0.00	15.1
1-Oct	0.01	15.9
2-Oct	0.00	15.1
3-Oct	0.00	12.5
4-Oct	0.00	12.8
5-Oct	0.01	13.8
6-Oct	0.00	14.7
7-Oct	0.00	15.9
8-Oct	0.01	16.3
9-Oct	0.01	15.3
10-Oct	0.01	14.9
11-Oct	0.00	15.0
12-Oct	0.00	13.1
13-Oct	0.00	12.7
14-Oct	0.00	12.3
15-Oct	0.00	11.3
16-Oct	0.00	10.9
17-Oct	0.00	12.0
18-Oct	0.02	12.6
19-Oct	0.02	12.6
20-Oct	0.02	12.9
21-Oct	0.01	13.6
22-Oct	0.02	13.6

	Daily Chlorine (mg/L)	CPF Outlet Temperature (°C)
SNP Station	S13L1-007-2	
Water Licence Criteria	n/a	n/a
23-Oct	0.03	12.6
24-Oct	0.01	10.7
25-Oct	0.02	10.5
26-Oct	0.01	10.1
27-Oct	0.01	10.2
28-Oct	0.01	10.4
29-Oct	0.01	10.8
30-Oct	0.01	11.5
31-Oct	0.02	10.5
1-Nov	0.01	9.8
2-Nov	0.01	9.3
3-Nov	0.01	9.2
4-Nov	0.06	8.4
5-Nov	0.03	9.4
6-Nov	0.01	10.3
7-Nov	0.01	8.8
8-Nov	0.04	9.1
9-Nov	0.02	8.0
10-Nov	0.02	8.3
11-Nov	0.01	8.8
12-Nov	0.02	8.1
13-Nov	0.03	8.5
14-Nov	0.01	8.5
15-Nov	0.03	7.7
16-Nov	0.02	7.7
17-Nov	0.02	7.0
18-Nov	0.01	5.8
19-Nov	0.03	6.6
20-Nov	0.03	6.7
21-Nov	0.01	6.2
22-Nov	0.03	5.9
23-Nov	0.01	5.6
24-Nov	0.00	6.4
25-Nov	0.01	6.1
26-Nov	0.01	5.9
27-Nov	0.01	6.2
28-Nov	0.01	6.2

	Daily Chlorine (mg/L)	CPF Outlet Temperature (°C)
SNP Station	S13L1-007-2	
Water Licence Criteria	n/a	n/a
29-Nov	0.01	6.1
30-Nov	0.01	6.4
1-Dec	0.01	6.1
2-Dec	0.01	4.2
3-Dec	0.01	4.9
4-Dec	0.01	5.3
5-Dec	0.01	5.1
6-Dec	0.01	6.4
7-Dec	0.01	7.1
8-Dec	0.01	7.0
9-Dec	0.02	7.2
10-Dec	0.00	6.9
11-Dec	0.03	5.9
12-Dec	0.04	5.1
13-Dec	0.01	5.0
14-Dec	0.00	5.4
15-Dec	0.01	4.2
16-Dec	0.00	5.0
17-Dec	0.01	5.5
18-Dec	0.01	7.0
19-Dec	0.00	7.4
20-Dec	0.00	6.9
21-Dec	0.01	7.4
22-Dec	0.01	7.4
23-Dec	0.03	6.1
24-Dec	0.06	6.5
25-Dec	0.01	4.4
26-Dec	0.00	4.5
27-Dec	0.00	4.3
28-Dec	0.01	6.2
29-Dec	0.00	6.5
30-Dec	0.00	5.5
31-Dec	0.02	4.4

*Norman Wells facility non-operational for planned maintenance shutdown

Table A-4: Four Week Rolling Average (S13L1-007-02)

	TPH (mg/L)	Phenols (mg/L)	TSS (mg/L)	pH	Specific Conductivity (uS/cm)	Daily Chlorine (mg/L)	Temperature (C)
Max. Average Limit	3 mg/L	0.07 mg/L	n/a	6.0-9.0	n/a	n/a	n/a
Jan 1 - 31	<2.0	0.0015	2.6	7.7	248.9	0.0	6.7
Feb 1 - 28	<2.0	<0.0015	1.51	7.99	237.50	0.00	6.09
March 1 - 31	<2.0	<0.0015	1.90	8.00	235.56	0.01	7.37
April 1-31	<2.0	<0.0015	1.73	8.01	237.78	0.01	10.56
May 1-31	<2.0	0.0019	19.97	8.03	247.78	0.01	14.65
June 1-30	<2.0	<0.0015	22.00	8.00	247.14	0.00	21.69
July 1 - 11*	<2.0	<0.0015	33.50	8.08	245.00	0.00	24.31
Aug 22 - 31*	<2.0	<0.0015	14.00	7.88	276.67	0.00	19.03
Sept 1 - 30	<2.0	0.0015	17.94	8.08	266.67	0.00	18.04
Oct 1 - 31	<2.0	0.0019	16.46	7.72	265.00	0.01	12.81
Nov 1 - 30	<2.0	0.0016	6.37	8.10	267.78	0.02	7.57
Dec 1 - 31	<2.0	0.0017	2.79	7.91	265.56	0.01	5.83

*Norman Wells facility non-operational for planned maintenance shutdown

**Table A-5: Quarterly Acute Lethality Data
CPF Outlet (S13L1-007-2)**

Date	Rainbow Trout (% Survival)	Daphnia Magna (% Survival)
Licence Criteria	>50% survival	>50% survival
Q1	100%	100%
Q2	100%	100%
Q3	100%	100%
Q4	100%	100%

Table A-6: Quarterly Inlet Data

SNP S13L1-007-1 (Inlet)					
	Q1 (mg/L)	Q2 (mg/L)	Q3 (mg/L)	Q4 (mg/L)	YTD Average (mg/L)
pH	7.65	8.13	8.14	7.06	7.75
Phenols	<0.0015	<0.0015	<0.0015	0.0018	0.0016
Dissolved Sodium	7	5.8	7.5	8.2	7.13
Total Sodium	7.5	5.7	7.6	7.9	7.18
Dissolved Potassium	0.78	0.86	0.88	1	0.88
Total Potassium	0.95	1.4	1.7	1.6	1.41
Dissolved Sulphate	29	34	36	33	33.0
Dissolved Chloride	10	5.6	7.8	10	8.4
Dissolved Calcium	23	30	32	29	28.5
Total Calcium	26	32	53	43	38.5
Dissolved Magnesium	7.6	8.2	8.9	9.9	8.65
Total Magnesium	9.1	9.1	16	16	12.6
Total Alkalinity	75	76	92	84	81.8
Specific Conductivity	240	250	280	260	257.5
Total Suspended Solids	3.3	33	7.5	99	35.7
Total Dissolved Solids	150	120	160	170	150.0
Total Petroleum Hydrocarbons	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus	<0.10	<0.10	0.17	0.22	0.15
Total Hardness	88	110	120	110	107

Table A-7: Quarterly Outlet Data

SNP S13L1-007-2 (Outlet)					
	Q1 (mg/L)	Q2 (mg/L)	Q3 (mg/L)	Q4 (mg/L)	YTD Average (mg/L)
pH	7.39	7.93	8.07	7.32	7.68
Phenols	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015
Dissolved Sodium	6.7	5.8	7.2	8.3	7.0
Total Sodium	7.6	6.1	7.6	8.6	7.5
Dissolved Potassium	0.78	0.86	0.75	0.98	0.84
Total Potassium	1.0	1.0	1.2	1.1	1.1
Dissolved Sulphate	29	34	35	33	32.8
Dissolved Chloride	10	6.9	8.4	10	8.8
Dissolved Calcium	22	30	27	28	26.8
Total Calcium	27	31	32	29	29.8
Dissolved Magnesium	7.3	7.8	7.9	9.7	8.2
Total Magnesium	9.6	8.7	9.9	11	9.8
Total Alkalinity	76	83	83	81	80.8
Specific Conductivity	240	250	260	250	250.0
Total Suspended Solids	9.1	11	6	<1.0	6.7
Total Dissolved Solids	130	88	140	140	124.5
Total Petroleum Hydrocarbons	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus	<0.10	<0.10	<0.10	<0.10	<0.10
Total Hardness	84	110	99	110	100.8

Appendix B Surface Water Runoff Data

Table B-1: 2021 Surface Water Discharge Analytical Results for Category A Locations

	Date	Total Discharge Volume (m³)	Chlorides (mg/L) (Y/N)	pH	Sheen (Y/N)
Sample Limits			< 500	6.0-9.0	N
Mainland - May 2021					
D42 area	3-May	93	Y	7	N
D42 area	4-May	186	Y	7	N
D42 area	5-May	279	Y	7	N
C-37 lease	7-May	248	Y	7	N
C-37 lease	8-May	186	Y	7	N
Culvert south of E-30	9-May	170	Y	7	N
LT 11	26-May	170	Y	7	N
LT 11	27-May	170	Y	7	N
LT 11	28-May	170	Y	7	N
LT 11	29-May	170	Y	7	N
Mainland - June 2021					
LT 11	23-Jun	170	Y	7	N
LT 11	5-Jun	170	Y	7	N
Bear Island - June 2021					
M-43 Start	27-Jun	12	Y	6	N
M-43 Mid	27-Jun		Y	6	N
M-43 End	27-Jun		Y	6	N
O-36	27-Jun	3	Y	6	N
M-46 Start	27-Jun	12	Y	6	N
M-46 Mid	27-Jun		Y	6	N
M-46 End	27-Jun		Y	6	N
Goose Island - June 2021					
Q-06	23-Jun	2	Y	6.5	N
Q-08	23-Jun	2	Y	6	N
P-12 Start	24-Jun	24	Y	6	N
P-12 Mid	24-Jun		Y	6	N
P-12 End	24-Jun		Y	6	N
O-12 Start	24-Jun	12	Y	6	N
O-12 Mid	24-Jun		Y	6	N
O-12 End	24-Jun		Y	6	N
O-10x-S	24-Jun	16	Y	6.5	N

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O-10x-M	24-Jun		Y	6.5	N
O-10x-E	24-Jun		Y	6.5	N
S-08-S	24-Jun	12	Y	6	N
S-08-M	24-Jun		Y	6	N
S-08-E	24-Jun		Y	6	N
N-13	26-Jun	3	Y	6	N
O-17 Start	27-Jun	12	Y	6	N
O-17 Mid	27-Jun		Y	6	N
O-17 End	27-Jun		Y	6	N
Q17-1 Start	26-Jun	16	Y	6	N
Q17-1 Mid	26-Jun		Y	6	N
Q17-1 End	26-Jun		Y	6	N

Table B-2: 2021 Surface Water Discharge Analytical Results for Category B Locations

	Date	Start/ Middle/ End	Total Discharge Volume (m³)	Total Petroleum Hydrocarbons (mg/L)	Phenols (mg/L)	Chlorides (mg/L)	pH	Total Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Specific Conductivity (uS/cm)
Max Grab Sample Limit				5	0.14	<500	6.0-9.0			
Mainland Areas - May 2021										
CPF Impound Basin	11-May	Start	1900	<2.0	0.0042	4.7	7.94	3.1	300	380
	18-May	Mid 1		<2.0	0.0052	5.1	7.99	5.1	330	490
	25-May	Mid 2		<2.0	0.0047	6.1	8.13	2.5	360	570
Refinery Impound Basin	3-May	Start	15700	<2.0	0.0055	7.7	7.57	2.7	210	360
	11-May	Mid 1		<2.0	0.0059	7.1	8.03	3.7	320	440
	18-May	Mid 2		<2.0	0.0082	9.5	8.05	8.1	280	510
	25-May	Mid 3		<2.0	0.0044	13	8.20	2.2	350	580
LT-11 Impound Basin	11-May	Start	750	<2.0	0.0094	3.6	7.79	1.8	260	260
	18-May	Mid 1		<2.0	0.011	5	7.76	2.5	210	370
	25-May	Mid 2		<2.0	0.0085	5.1	8.01	1.6	330	460
Refinery Waterflood Basin	11-May	Start	0	<2.0	0.0032	3	8.03	6.1	160	160
	18-May	Mid 1	0	<2.0	0.005	19	7.84	2.5	420	650
	25-May	Mid 2	0	<2.0	0.0021	26	8.40	1.3	440	800
Misc. Mainland Impound Areas - May 2021										
RTF 112	25-May	Start	0	<2.0	0.004	8.2	8.00	1.2	230	370
RTF 116	27-May	Start	0	<2.0	0.0077	13	8.15	1.5	310	520
RTF 109	27-May	Start	0	<2.0	0.0031	5.9	8.24	1.1	360	510
RTF 119	27-May	Start	0	<2.0	0.0048	7.1	8.15	2.7	260	390
RTF 121	27-May	Start	0	<2.0	0.0037	8.7	8.10	2.1	260	400
Mainland Areas - June 2021										
CPF Impound Basin	1-Jun	Mid 3	1600	<2.0	0.0016	10	8.2	7.3	850	1100

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	8-Jun	Mid 4		<2.0	0.0055	9.4	7.61	3.8	910	1200
	15-Jun	Mid 5		<2.0	0.0033	7.9	8.15	14	640	1100
	22-Jun	Mid 6		<2.0	0.0021	10	7.67	3.3	860	1200
	29-Jun	Mid 7		<2.0	0.0041	9.7	8.09	1.3	1100	1400
LT-11	1-Jun	Mid 3	62	<2.0	0.0049	5	8.06	2.4	460	700
	8-Jun	Mid 4		<2.0	0.0018	6	7.54	<1.0	440	760
	15-Jun	Mid 5		<2.0	0.0061	4.4	7.93	<1.0	420	710
	22-Jun	Mid 6		<2.0	0.0018	5.4	7.54	<1.0	470	720
	29-Jun	Mid 7		<2.0	0.0029	8.1	7.87	2.7	550	810
Refinery Impound Basin	1-Jun	Mid 4	1800	<2.0	0.0041	25	8.34	3.7	520	790
	15-Jun	Start	5700	<2.0	<0.0015	28	8.25	<1.0	440	860
	22-Jun	Mid 1		<2.0	<0.0015	27	7.85	1.9	560	910
	29-Jun	Mid 2		<2.0	0.0019	29	8.44	2.2	570	850
Refinery Waterflood Basin	1-Jun	Mid 3	0	<2.0	0.0029	29	8.57	1.1	520	900
	8-Jun	Mid 4	0	<2.0	0.0038	29	8.45	<1.0	480	910
	15-Jun	Mid 5	0	<2.0	0.0021	30	8.59	15	290	910
	22-Jun	Mid 6	0	<2.0	<0.0015	29	8.2	4.1	440	870
	29-Jun	Mid 7	0	<2.0	0.0024	29	1.2	8.56	530	900
Misc. Mainland Impound Areas - June 2021										
RTK 112	1-Jun	Mid 1	0	<2.0	0.0032	9.3	8.21	2	270	430
	3-Jun	Mid 1		<2.0	0.0018	10	7.9	2.2	280	440
	8-Jun	Mid 2		<2.0	0.0025	11	7.87	<1.0	280	470
	15-Jun	Mid 3		<2.0	0.0032	10	8.12	<1.0	300	520
RTK 105	1-Jun	Mid 1	0	<2.0	0.0039	4.4	8.27	1.6	350	540
	8-Jun	Mid 2		<2.0	0.0035	6.8	7.71	<1.0	360	610
RTK 101	1-Jun	Mid 1	0	<2.0	0.0049	2.6	8.26	1.3	240	360
RTK 116	3-Jun	Mid 1	0	<2.0	0.0036	16	8.03	2.1	300	520
	22-Jun	Start		<2.0	<0.0015	24	7.77	3.3	410	710
RTK 109	3-Jun	Mid 1	0	<2.0	0.0024	6	8.21	1.7	360	510
	22-Jun	Start		<2.0	<0.0015	5.9	7.95	<1.0	480	720

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RTK 119	3-Jun	Mid 1	0	<2.0	0.0048	7.3	7.89	3.1	290	400
RTK 102	8-Jun	Start	0	<2.0	0.005	3.6	8.13	1.2	220	350
Mainland Areas - July 2021										
CPF Impound Basin	6-Jul	Mid 8	0	<2.0	0.0029	8.6	7.92	3.7	1000	1500
	13-Jul	Mid 9		<2.0	<0.0015	9.6	7.88	8.7	1100	1600
	20-Jul	Mid 10		<2.0	<0.0015	5.8	8.06	3.1	420	1600
	27-Jul	Mid 11		<2.0	<0.0015	9.0	7.32	3.7	1300	1500
Refinery Impound Basin	6-Jul	Mid 3	0	<2.0	0.0039	31	8.49	1.6	420	800
	20-Jul	Start		<2.0	0.0021	28	8.83	12	1200	750
	27-Jul	Mid 1		<2.0	0.0036	33	8.99	<1.0	500	730
Refinery Waterflood Basin	6-Jul	Mid 8	0	<2.0	0.0034	30	8.52	<1.0	410	900
	13-Jul	Mid 9		<2.0	0.0040	31	8.42	2.1	400	920
	20-Jul	Mid 10		<2.0	<0.0015	26	8.65	3.9	500	930
	27-Jul	Mid 11		<2.0	<0.0015	31	8.45	<1.0	550	940
Mainland Areas - August 2021										
CPF Impound Basin	3-Aug	Start	0	<2.0	<0.0015	9.3	7.54	3.5	1300	1600
	10-Aug	Mid 1		<2.3	<0.0015	8.3	7.71	5.5	1000	1400
	17-Aug	Mid 2		<2.0	<0.0015	9.0	7.66	3.2	1100	1400
	30-Aug	Mid 3		<2.0	<0.0015	9.9	7.43	33	1300	1500
Refinery Impound Basin	3-Aug	Start	237**	<2.0	0.0026	34	9.18*	<1.0	430	710
	10-Aug	Mid 1	0	<2.0	<0.0015	33	9.02*	5.3	380	690
	12-Aug	Mid 2		<2.0	<0.0015	33	9.20*	3.2	470	690
	17-Aug	Mid 3		<2.0	0.0023	33	8.41	<1.0	410	680
	20-Aug	Mid 4		<2.0	<0.0015	33	9.21*	2.9	520	680
	23-Aug	Mid 5		<2.0	<0.0015	33	9.15*	1.8	480	680
	30-Aug	Mid 6		<2.0	0.0075	37	8.5	3.5	470	820
Refinery Waterflood Basin	3-Aug	Start	0	<2.0	0.0019	32	8.64	<1.0	500	940
	10-Aug	Mid 1		<2.0	0.0015	34	8.30	<1.0	460	990
	17-Aug	Mid 2		<2.0	<0.0015	34	8.50	1.4	560	980
	30-Aug	Mid 3		<2.0	<0.0015	35	8.62	58	1300	1000

Mainland Areas - September 2021										
CPF Impound Basin	7-Sep	Start	6,578	<2.0	<0.0015	11	7.87	<1.0	1300	1600
	13-Sep	Mid 1		<2.0	<0.0015	7.9	8.05	<1.0	140	320
	21-Sep	Mid 2		<2.0	<0.0015	9.8	7.67	4.4	570	800
Refinery Impound Basin	3-Sep	Start	1,834	<2.0	0.0026	38	8.52	9.5	480	840
	7-Sep	Mid 1		<2.0	0.0017	37	8.53	<1.0	520	870
	14-Sep	Mid 2		<2.0	<0.0015	38	8.55	<1.0	560	870
Refinery Waterflood Basin	7-Sep	Start	0	<2.0	<0.0015	34	8.51	2.0	570	1000
	14-Sep	Mid 1		<2.0	0.0020	36	8.40	15	640	1100

*pH exceedances caused by excessive vegetation growth in the Refinery Impound Basin as discussed in Section 5.2

**Initial discharge of 237 m3 took place on August 2nd before pH exceedances were detected. Discharge stopped on August 3rd and resumed in September once approval from CIRNAC was obtained

Appendix C SNP – Groundwater



2021 SNP Groundwater Quality Monitoring

Norman Wells, NT

Imperial

28 March 2022

417085-31872-21100

Advisian
Worley Group

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THIS REPORT CONTAINS PROVISIONS LIMITING LIABILITY, THE SCOPE OF THE REPORT AND THIRD-PARTY RELIANCE

These documents and the information contained therein are confidential, property of Imperial Oil and any disclosure of same is governed by the provisions of each of the applicable provincial and territorial freedom of information legislation, the Privacy Act (Canada) 1980-81-82-83, c.111, Sch.II"1", and the Access to Information Act (Canada) 1980-81-82-83, c.111, Sch.I"1", as such legislation may be amended from time to time.

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A	Issued as Draft	 S. Bowles	 M. Brown	 A. Haigh	22-Mar-2022
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Appendices

Appendix A Limitation of Liability, Scope of Report, and Third-Party Reliance

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Appendix C Field Methodologies

Appendix D Laboratory Analytical Reports

Appendix E Quality Assurance/Quality Control

Appendix F Mann–Kendall Statistical Analyses

1 Introduction

The Imperial Oil Resources N.W.T. Limited (Imperial) Norman Wells Operation is an upstream oil and gas field located 700 km northwest of Yellowknife, Northwest Territories (NT; Latitude 65° 17' N, Longitude 126°51 W; the "Site"). Operations include a Central Processing Facility (CPF) on the northeastern shore of the Mackenzie River which receives production from wells on the mainland, three natural islands (Goose Island, Bear Island and Frenchy's Island) and six artificial islands (Figure 1). Work was conducted for Imperial under Imperial Oil Limited Contract A2275233.

Limitations of Liability, Scope of Report and Third-Party Reliance for this report are provided in Appendix A.

1.1 Background

The Norman Wells Operations Groundwater Management Plan (GMP) was created in September 2014 (and updated in September 2015) as part of Imperial's Water Licence Renewal Application submitted to the Sahtu Land and Water Board (Imperial 2014, 2015). A key component of the GMP is the sampling of a select subset of existing groundwater monitoring wells installed at strategic locations between operating facilities and potential receptors across the Site, referred to as the Groundwater Surveillance Network Program (SNP). These wells are sampled twice annually in accordance with the GMP, in order to provide ongoing monitoring of groundwater conditions adjacent to Site activities. The goal of the SNP is to identify existing groundwater quality issues and to provide early detection of groundwater changes across the Site.

2 Scope of Work

Worley Canada Services Ltd. (Worley), operating as Advisian, was retained by Imperial to conduct groundwater monitoring and sampling activities for the established surveillance network. The scope of work for the 2021 groundwater monitoring program at the Site included the following:

- Check monitoring well integrity and measure static groundwater levels of 15 groundwater monitoring wells;
- Collect groundwater samples for laboratory analysis of dissolved chloride and benzene, toluene, ethylbenzene and total xylenes (BTEX), as well as petroleum hydrocarbon (PHC) fractions F1 and F2, and select metals and major ions as per the GMP; and
- Provide a summary report presenting the results of the 2021 groundwater sampling program.

The GMP lists chloride and BTEX as the primary indicator parameters. Due to established laboratory analytical packages, additional analyses were also completed. The scope of this report is to review the primary indicator parameters per the GMP.

3 Environmental Assessment Guidelines

At present, no specific groundwater quality guidelines exist for the NT. As a conservative measure, groundwater quality assessment parameters in this report are compared to the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (CEQG) for the Protection of Freshwater Aquatic Life (FWAL; CCME 2019), as surface water bodies (e.g., Bosworth Creek and the Mackenzie River) are potential receptors of groundwater in most areas of interest for this program.

Background concentrations of key geochemical parameters were calculated in 2019 for different geographical areas and geological units using data collected primarily between 1998 and 2019 (Appendix B). Background groundwater geochemical parameters were characterized throughout the Site, based on the hydrogeological zone where the monitoring well is completed, as well as evidence for the presence or absence of natural crude oil and saline water seepage in the vicinity. Relevant background concentrations are also provided in the analytical tables for comparison to the collected data.

It should be emphasized that the aforementioned guidelines are used for comparative purposes only in the context of this report.

4 Groundwater Monitoring Network

Twelve monitoring wells and three contingency wells make up the SNP per Imperial's Water Licence S13L1-007. These wells were selected based on proximity to operating facilities and potential receptors, historical groundwater quality, well completion information, and overall Site coverage. The contingency wells serve as replacement sampling locations in the event that a primary SNP monitoring well is dry, damaged, frozen, or otherwise cannot produce water during a scheduled sampling event.

The main receptors identified during the development of the SNP were the Mackenzie River, Bosworth Creek, and the Town of Norman Wells. A summary of the selected monitoring wells is provided below as Table 4-1.

Table 4-1 SNP Monitoring Locations

Monitoring Well	Location	Rationale for Selection
CPF 97-7-5	Mainland West	Situated between CPF and Bosworth Creek
CPF 98-8-3	Mainland West	Situated between CPF and Mackenzie River
WSY 97-1-5	Mainland East	Situated between Well Services Yard and Bosworth Creek
ARB-12-3-3	Mainland East	Adjacent Biocell 1
C38 08-1-4	Mainland East	Situated between known historical well issues (C-36X) and Mackenzie River
TF 03-12-3	Mainland East	Situated between Tank Farm and Mackenzie River; downgradient of known hydrocarbon source
MTF 97-1-5	Mainland East	Situated between Tank Farm and Town of Norman Wells
BIS 97-1-3	Bear Island	Situated between Bear Island Sump #5 and the Mackenzie River
BI-13-3-4.5	Bear Island	Situated near Bear Island Sump #6 and the Mackenzie River
BIBG-20-01-4	Bear Island	Situated at western edge of development on Bear Island, near Mackenzie River
GIBG-10-2-3	Goose Island	Situated between well pads and Mackenzie River
GIQ8-10-2-4	Goose Island	Situated between fuel storage/handling area and the Mackenzie River
GIP11 09-1-4-R	Goose Island	Situated between a sump and the Mackenzie River - reinstalled as GIP11 09-1-4-R in 2018
Contingency Wells*		
MEBG-10-1-3	Mainland East	Situated between Mainland Sumps and Mackenzie River
BI-13-1-4	Bear Island	Situated near Bear Island Sump #6 and the Mackenzie River
Inactive Wells**		
GIP11 09-1-4	Goose Island	Situated between a sump and the Mackenzie River – well was abandoned in 2018 and reinstalled as GIP11 09-1-4-R
BIBG-10-1-4	Bear Island	Situated at western edge of Bear Island, south of the Mackenzie River – meant to replace damaged SNP well BIBG-12-1-7 – noted damaged in 2020 replaced by BIBG-20-01-4

Monitoring Well	Location	Rationale for Selection
BIBG-12-1-7	Bear Island	Situated at western edge of development on Bear Island, near Mackenzie River – well was replaced by BIBG-20-1-4 in fall 2020

* Wells serve as contingency monitoring locations in the event that a sample cannot be collected from all primary SNP locations.

**Wells that have been damaged and are replaced but historical data are reported.

In 2018, GIP11 09-1-4 was abandoned and reinstalled as GIP11 09-1-4-R in the same location at the same depth, as the original well was damaged and could not be sampled.

In 2019, BIBG-10-1-4 was sampled instead of the primary SNP well BIBG-12-1-7, which was badly damaged. During 2020, well BIBG-10-1-4 was also observed to be damaged and could not be sampled in the fall. A new well (BIBG-20-01-4) was installed to replace both BIBG-12-1-7 and BIBG-10-1-4. Installation details for the new well are provided in Table 1.

Historical data for GIP11 09-1-4, BIBG-12-1-7, and BIBG-10-1-4 are included in this report for comparison purposes.

5 Field Methodology

5.1 Groundwater Sampling

The SNP groundwater monitoring was conducted by Advisian personnel in August and September 2021.

Groundwater samples were collected using dedicated/disposable bailers following no-purge methodology. A total of 30 samples, including 25 groundwater samples, four field duplicate samples and one trip blank sample, were collected in pre-cleaned laboratory-provided bottles as part of the SNP. Results were compared to the CCME FWAL guidelines, background chemistry, and historical records, as applicable.

All groundwater samples were submitted for laboratory analysis at an accredited third-party laboratory in Edmonton (Bureau Veritas) in accordance with standard packaging, preservation, and chain-of-custody (COC) procedures.

The methodology for collecting groundwater samples is detailed in Appendix C and laboratory analytical reports are provided in Appendix D.

5.2 Statistical Analyses

5.2.1 Shewhart-Cumulative Sum Trend Analyses

Combined Shewhart–Cumulative Sum (CUSUM) control charts provide a common means of statistical trend evaluation in many environmental monitoring programs and are in fact the only statistical procedure that is directly recommended for use in intra-well monitoring by the United States Environmental Protection Agency (USEPA; 1989, 1992). The Shewhart control chart is designed to detect an immediate increase over the background distribution for a particular monitoring parameter, whereas the CUSUM control chart is designed to detect more gradual increases over background (Gibbons 1999).

5.2.2 Mann-Kendall Statistical Analyses

The non-parametric Mann–Kendall test for trend can be used in combination with a modified version of Sen's non-parametric slope estimator (Gibbons 1994). In both tests, four or more points of data are placed in chronological order, and the sign of the differences between all forward combinations of data pairs are used to compute the Mann–Kendall statistic (S). The Mann–Kendall statistic (S), along with the number of data points (n), is used for the normal approximation test, and the results yield a probability from 0 to 1.

Sen's slope is used to provide an approximate magnitude of change on trend lines. Sen's slope is calculated by evaluating the slope between all forward combinations of data pairs. The slopes are then ranked, and the median slope value is selected. Unlike least squares regression, the Sen's slope is not greatly affected by gross outliers, which are occasionally encountered in groundwater chemistry data. Slopes are presented in absolute terms [milligrams per litre (mg/L) per year] and/or normalized relative to the median concentration (% change per year).

In each case, trend analyses are conducted using the available data series collected following installation of the monitoring wells. The Mann–Kendall statistics are evaluated only on datasets where at least four data points exist. It is important to note that some parameters returned “below detection” results for part or all of the location’s sampling history.

To indicate potentially significant temporal trends, results are screened according to three criteria:

- the probability of a trend;
- slope (e.g., in mg/L per year); and
- normalized slope (in % per year).

Location-specific discussions of statistical trend details and results are provided in Section 6.3.

6 Results and Interpretation

Water samples were collected in the summer and fall from all sampling locations except for BIBG-12-1-7, GIBG-10-2-3, GIP11 09-1-4R (spring) and BIBG-20-1-4. Well BIBG-12-1-7 was first observed to be damaged in 2015 and could not be located in 2020, so is presumed destroyed. A sample was collected in the spring of 2020 from nearby monitoring well BIBG-10-1-4 for the purposes of maintaining adequate spatial coverage, but this well was also observed to be damaged and has not been sampled since. Monitoring well BIBG-20-1-4 was installed in 2020 to serve as a replacement sampling location for BIBG-12-1-7, but was observed to have been damaged by ice when visited in 2021. GIBG-10-2-3 was also observed to have been damaged by ice in 2021 and was not sampled. GIP11 09-1-4R could not be located in the of spring 2021 and was not sampled.

6.1 Site Hydrogeology

Monitoring well datum and groundwater surface elevations are presented in Table 1 and Figures 2A/B and 3A/B. Elevations are provided in metres above sea level (masl).

6.1.1 Mainland

Groundwater surface elevations do not indicate a consistent groundwater flow direction for the Mainland area. This is due, in part, to the wide spatial distribution of the SNP monitoring wells, and to the presence of discontinuous permafrost beneath the Site. Ice lenses in the subsurface act as barriers to groundwater movement, due to the comparatively low hydraulic conductivity associated with frozen soil. As a result, groundwater flow conditions beneath the Site are complex, and small-scale local variations are inferred to be present in many areas.

Generally speaking, groundwater is inferred to flow predominantly towards the Mackenzie River, with localized flow towards Bosworth Creek. More extensive historical monitoring events at the Site confirm this interpretation (Advisian 2019).

Groundwater surface elevations ranged from 56.79 to 63.66 masl in August (Figure 2A) and from 56.66 to 63.55 masl in September (Figure 2B). In general, hydraulic head is higher towards the north end of the Site and decreases with proximity to the Mackenzie River, following local topography.

6.1.2 Bear Island and Goose Island

Generally, groundwater surface elevations on Bear Island and Goose Island mimic the surface topography, with local flow directions inferred to be from high ground towards the closest surface water body. In most cases, the closest water body is the Mackenzie River; however, a number of unnamed surface water bodies also exist on both Islands (Figure 1).

Groundwater surface elevations on Bear Island ranged from 49.73 to 49.76 masl in August (Figure 3A) and from 48.34 to 49.73 masl in September (Figure 3B).

The groundwater surface elevation on Goose Island was 45.41 masl in August (Figure 3A) and 45.33 masl in September (Figure 3B) at GIQ8-10-2-4. Groundwater surface elevation ranges could not be calculated in 2021 due to GIBG-10-2-3 being damaged by ice and GIP11 09-1-4-R missing survey data.

6.2 Groundwater Analytical Results

Current groundwater chemistry data for primary indicator parameters (chloride and BTEX) are presented in Table 2. Analytical exceedances, as compared to the CCME FWAL guidelines and background chemistry, are presented in Figures 4A/B and 5A/B.

The 2021 laboratory analytical reports, including primary indicator parameters and other associated chemistry data, are compiled in Appendix D. A description and summary of the quality assurance and quality control (QA/QC) program is provided in Appendix E.

The background geochemistry for the Norman Wells field was revised in 2019 (Appendix B). Estimated natural background geochemistry for shallow groundwater has been included for comparison purposes in Table 2. These background values are referred to periodically in the discussion below.

6.2.1 Dissolved Chloride

Two monitoring wells (TF 03-12-3 and WSY 97-1-5) had dissolved chloride concentrations below the CCME FWAL guideline but above the calculated background concentration for Mainland surficial sediments during one or both monitoring events in 2021 (Table 2).

All remaining 2021 analytical results were below both the CCME FWAL guideline and the calculated background concentrations for Mainland and Island surficial sediments (Figures 4A/B and Table 2).

6.2.2 Petroleum Hydrocarbon Parameters

All PHC parameter concentrations were below the applied guidelines and reported detection limits (RDLs), with the exception of below-guideline detections of benzene at C38 08-1-4 (summer and fall) and xylenes at GIQ8-10-2-4 (summer only; Figures 5A/B and Table 2). Both benzene results were less than 5x the RDL. Benzene was first detected at C38 08-1-4 in 2019. The xylenes detection was a first-time detection at GIQ8-10-2-4, but the subsequent fall sample was below the laboratory detection limit.

6.3 Mann-Kendall Statistical Analyses

Mann-Kendall statistical analyses have been performed for primary indicator parameters having four or more historical data points.

Locations were identified as exhibiting statistically-notable trends if the following criteria were met:

- >95% probability of occurrence (two-sided p-value <0.05); and
- Significant rate of change (normalized slope > ±10% per year).

A decreasing trend indicates that concentrations are decreasing over time, while an increasing trend indicates that concentrations are increasing over time. Statistical analyses, trend charts, and a summary table are presented in Appendix F, and relevant trends are summarized in Table 6-1.

Table 6-1 Statistically-Notable Groundwater Hydrochemical Trends

Monitoring Location	Parameter	Trend	N*	Discussion
BIBG-10-1-4	Chloride	↑	13	Increasing trend in dissolved chloride concentrations supported by 13 data points. Field observations indicate that this well may be damaged below grade and results may not be representative of aquifer conditions. Concentrations remain well below the CCME FWAL guideline. No samples collected from BIBG-10-1-4 in 2020, this trend was previously identified in 2020.
GIP11 09-1-4-R	Chloride	↓	7	Decreasing trend in dissolved chloride concentrations supported by 7 data points.

Note: N = Number of supporting data points in historical dataset.

7 Field and Laboratory Quality Assurance/Quality Control

A QA/QC program was followed to manage and quantify the quality of the investigation results. The program included field procedures, laboratory procedures and the use of QC samples to quantify the results of the program.

Field QC sampling included four duplicate samples and one groundwater trip blank sample.

The laboratory QA/QC analyses are provided in the laboratory certificates of analysis, presented in Appendix D. The laboratory QA/QC program included calibration checks, surrogate matrix spikes, blanks and laboratory duplicates during analyses. Any data quality issues are discussed in the laboratory data checklists provided in Appendix D.

The results of the field QA/QC sample analyses are presented in Appendix E. Field QC sampling included four duplicate samples and one groundwater trip blank sample.

All trip blank results were below the laboratory RDLs (Table E-1).

Based on the QA/QC analyses, the data are considered fit for the purpose of this report.

8 Summary

Groundwater quality monitoring for the SNP was completed in August and September 2021. Activities included measurement of hydraulic head and collection of groundwater samples for laboratory analyses including primary indicator parameters (dissolved chloride and BTEX). A summary of the general conclusions from the 2021 sampling program is as follows:

- Due to the areal variability of permafrost presence across the Site and the wide spatial distribution of SNP wells, groundwater surface elevations from the SNP well network alone are insufficient to interpret a consistent flow direction. Based on more extensive monitoring programs at the Site, groundwater on the Mainland is generally inferred to flow predominantly towards the Mackenzie River, with localized flow towards Bosworth Creek. Groundwater surface elevations on Bear and Goose Island reflect the surface topography, with local flow directions inferred to be from high ground towards the closest surface water body;
- Dissolved chloride concentrations were below the applied CCME FWAL guideline at all monitoring locations, and exceeded the expected background concentration at two locations;
- Most analyzed PHC parameters results were below the applied guidelines and background concentrations, with the exception of C38-08-1-1 and GIQ8-10-2-4. Most were also below reportable detection limits, with the exception of benzene detected at C38 08-1-4 and xylenes at GIQ8-10-2-4 in 2021;
- Mann-Kendall trend analyses indicated one statistically-significant decreasing trend (dissolved chloride at GIP11 09-1-4-R); and
- BIBG-20-01-4 and GIBG-10-2-3 are primary SNP monitoring locations that are damaged. Per the terms of the SNP/GMP, these locations must be replaced, or suitable adjacent locations should be identified to maintain coverage.

9 Closure

We trust that this report satisfies your current requirements and provides suitable documentation for your records. If you have any questions or require further details, please contact the undersigned at any time.

Report Prepared by:

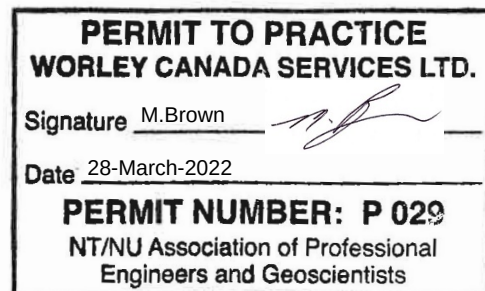


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Senior Review by:



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Hydrogeologist



Decommissioning & Restoration
Advisian | North America West

10 References

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Imperial (Imperial Oil Resources NWT Limited) 2014. Norman Wells Operations Groundwater Management Plan. Report prepared for the Sahtu Land and Water Board. September 2014.

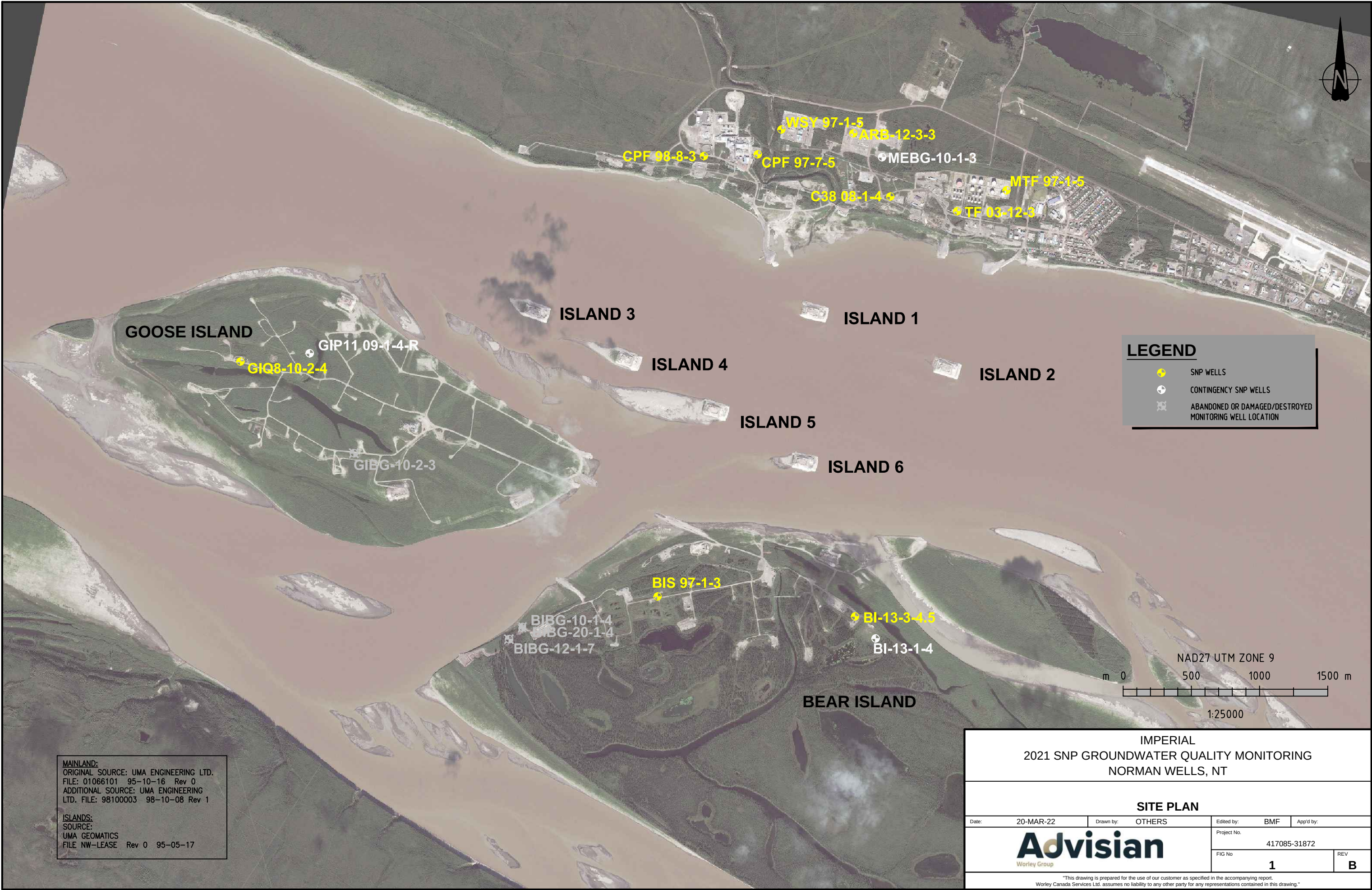
Imperial (Imperial Oil Resources NWT Limited) 2015. Norman Wells Operations Groundwater Management Plan. Report prepared for the Sahtu Land and Water Board. September 2015.

USEPA (United States Environmental Protection Agency) 1989. Interim Final Guidance Document: Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities. April 1989.

USEPA (United States Environmental Protection Agency) 1992. Addendum to Interim Final Guidance Document: Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities. July 1992.



Figures



MAINLAND:
ORIGINAL SOURCE: UMA ENGINEERING LTD.
FILE: 01066101 95-10-16 Rev 0
ADDITIONAL SOURCE: UMA ENGINEERING LTD.
FILE: 98100003 98-10-08 Rev 1

ISLANDS:
SOURCE:
UMA GEOMATICS
FILE NW-LEASE Rev 0 95-05-17

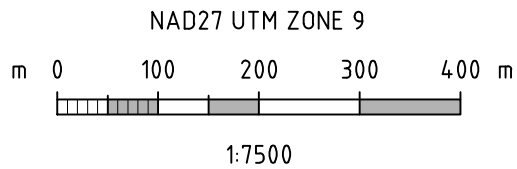
IMPERIAL 2021 SNP GROUNDWATER QUALITY MONITORING NORMAN WELLS, NT			
SITE PLAN			
Date: 20-MAR-22	Drawn by: OTHERS	Edited by: BMF	App'd by:
		Project No. 417085-31872	REV
		FIG No. 1	B
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LEGEND

-  INJECTION WELL LOCATION
-  PRODUCTION WELL LOCATION
-  ESSO LEASE BOUNDARY
-  PIPELINES
-  UTILIDOR LOCATION
-  MONITORING WELL LOCATION
-  GROUNDWATER SURFACE ELEVATION (m.a.s.l.) (AUGUST 2021)

SOURCES:
1. SITE PLAN AS PER UMA ENGINEERING LTD. FILES 010166101 (REV 0 DATED 95-10-16) AND 98100003 (REV 1 DATED 98-10-08).
2. 2017 AERIAL PHOTOGRAPH FROM PLANT LABS GEOMATICS CORP. IMAGE DATE AUGUST 6 AND 30, 2017.



IMPERIAL
2021 SNP GROUNDWATER QUALITY MONITORING
NORMAN WELLS, NT

GROUNDWATER SURFACE ELEVATIONS -
MAINLAND (AUGUST 2021)

Date:	20-MAR-22	Drawn by:	OTHERS	Edited by:	BMF	App'd by:	
Advisian Worley Group				Project No.			
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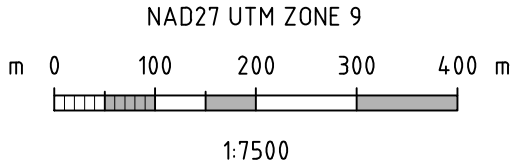
LEGEND

- INJECTION WELL LOCATION
- PRODUCTION WELL LOCATION
- ESSO LEASE BOUNDARY
- PIPELINES
- UTILIDOR LOCATION
- MONITORING WELL LOCATION
- (63.48)

GROUNDWATER SURFACE ELEVATION (m.a.s.l.) (SEPTEMBER 2021)
- (NM)

NOT MEASURED

SOURCES:
1. SITE PLAN AS PER UMA ENGINEERING LTD. FILES 010166101 (REV 0 DATED 95-10-16) AND 98100003 (REV 1 DATED 98-10-08).
2. 2017 AERIAL PHOTOGRAPH FROM PLANT LABS GEOMATICS CORP. IMAGE DATE AUGUST 6 AND 30, 2017.



IMPERIAL
2021 SNP GROUNDWATER QUALITY MONITORING
NORMAN WELLS, NT

GROUNDWATER SURFACE ELEVATIONS -
MAINLAND (SEPTEMBER 2021)

Date:	20-MAR-22	Drawn by:	OTHERS	Edited by:	BMF	App'd by:	
Project No.				417085-31872			
FIG No				2B		REV B	

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LEGEND

- 

INJECTION WELL LOCATION
- 

PRODUCTION WELL LOCATION
- 

ESSO LEASE BOUNDARY
- 

PIPELINES
- 

UTILIDOR LOCATION
- 

MONITORING WELL LOCATION
- 

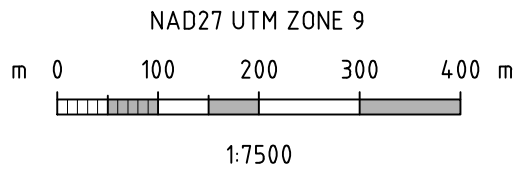
ABANDONED OR DAMAGED/DESTROYED MONITORING WELL LOCATION
- 

GROUNDWATER SURFACE ELEVATION (m.a.s.l.) (AUGUST 2021)
- 

NOT MEASURED (WELL ABANDONED OR DAMAGED/DESTROYED)
- 

SURVEY DATA OR WATER LEVEL MEASUREMENT NOT AVAILABLE

SOURCES:
1. SITE PLAN AS PER UMA ENGINEERING LTD. FILES 010166101 (REV 0 DATED 95-10-16) AND 98100003 (REV 1 DATED 98-10-08).
2. 2017 AERIAL PHOTOGRAPH FROM PLANT LABS GEOMATICS CORP. IMAGE DATE AUGUST 6 AND 30, 2017.



IMPERIAL
2021 SNP GROUNDWATER QUALITY MONITORING
NORMAN WELLS, NT

GROUNDWATER SURFACE ELEVATIONS -
GOOSE ISLAND AND BEAR ISLAND (AUGUST 2021)

Date:	20-MAR-22	Drawn by:	OTHERS	Edited by:	BMF	App'd by:	
Project No.				417085-31872			
FIG No				3A		REV	B

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Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."



LEGEND

- 

INJECTION WELL LOCATION
- 

PRODUCTION WELL LOCATION
- 

ESSO LEASE BOUNDARY
- 

PIPELINES
- 

UTILIDOR LOCATION
- 

MONITORING WELL LOCATION
- 

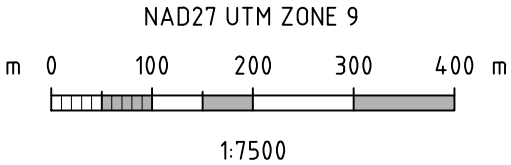
ABANDONED OR DAMAGED/DESTROYED MONITORING WELL LOCATION
- 

GROUNDWATER SURFACE ELEVATION (m.a.s.l.) (SEPTEMBER 2021)
- 

NOT MEASURED (WELL ABANDONED OR DAMAGED/DESTROYED)
- 

SURVEY DATA NOT AVAILABLE

SOURCES:
1. SITE PLAN AS PER UMA ENGINEERING LTD. FILES 010166101 (REV 0 DATED 95-10-16) AND 98100003 (REV 1 DATED 98-10-08).
2. 2017 AERIAL PHOTOGRAPH FROM PLANT LABS GEOMATICS CORP. IMAGE DATE AUGUST 6 AND 30, 2017.

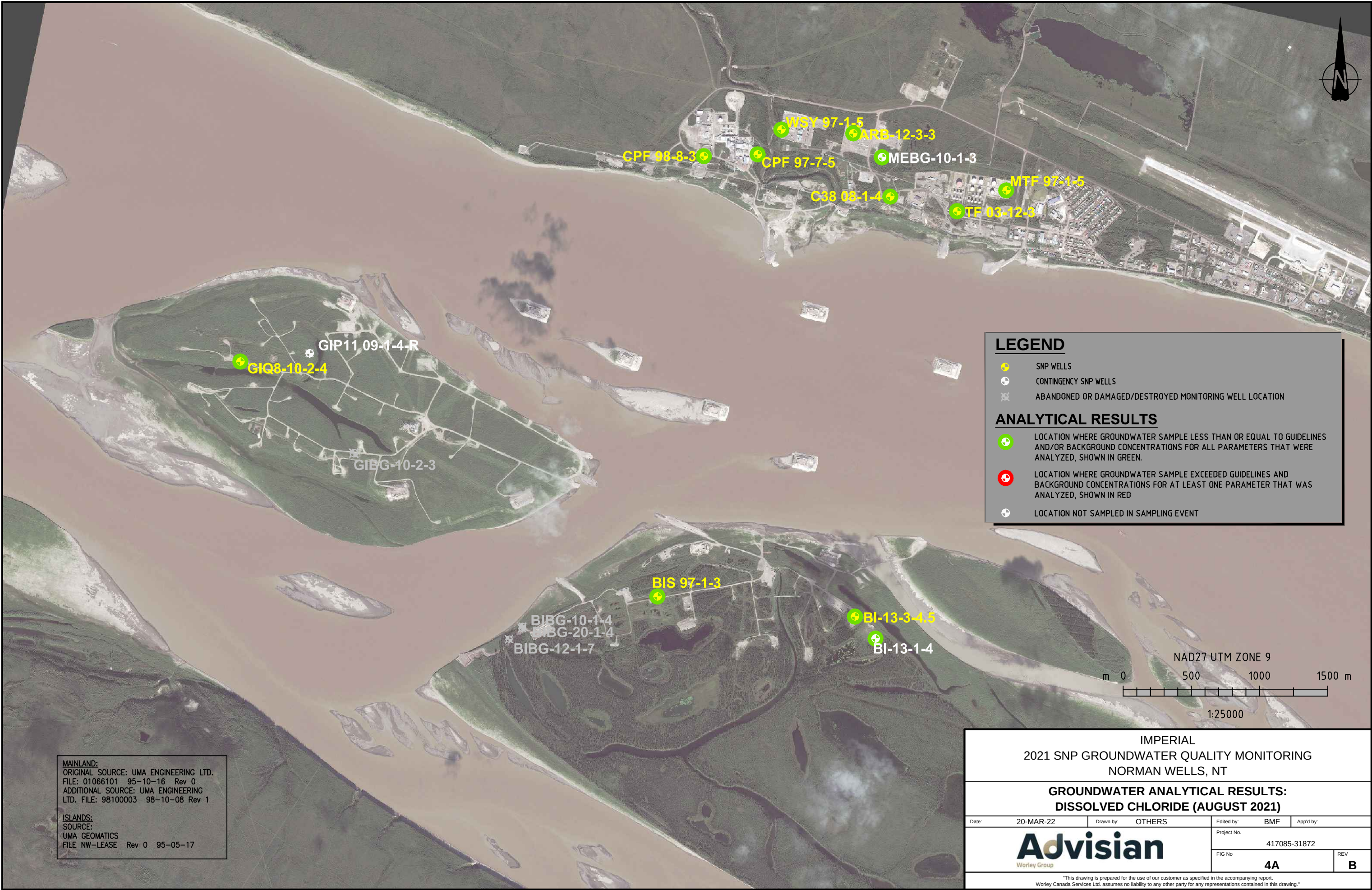


IMPERIAL
2021 SNP GROUNDWATER QUALITY MONITORING
NORMAN WELLS, NT

GROUNDWATER SURFACE ELEVATIONS -
GOOSE ISLAND AND BEAR ISLAND (SEPTEMBER 2021)

Date:	20-MAR-22	Drawn by:	OTHERS	Edited by:	BMF	App'd by:	
Project No.				417085-31872			
FIG No				3B		REV	B

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MAINLAND:
ORIGINAL SOURCE: UMA ENGINEERING LTD.
FILE: 01066101 95-10-16 Rev 0
ADDITIONAL SOURCE: UMA ENGINEERING LTD.
FILE: 98100003 98-10-08 Rev 1

ISLANDS:
SOURCE:
UMA GEOMATICS
FILE NW-LEASE Rev 0 95-05-17

LEGEND

SNP WELLS

CONTINGENCY SNP WELLS

ABANDONED OR DAMAGED/DESTROYED MONITORING WELL LOCATION

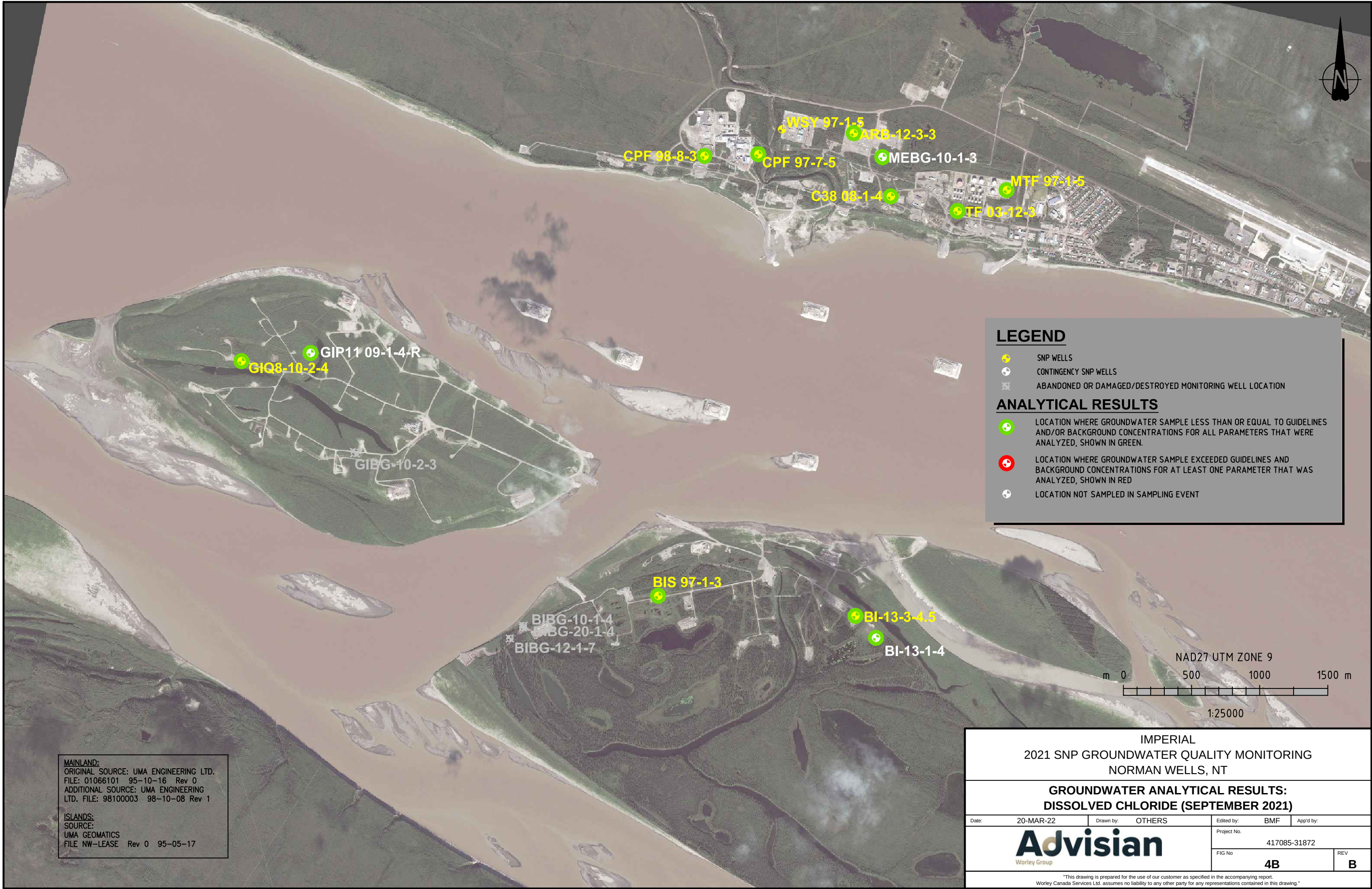
ANALYTICAL RESULTS

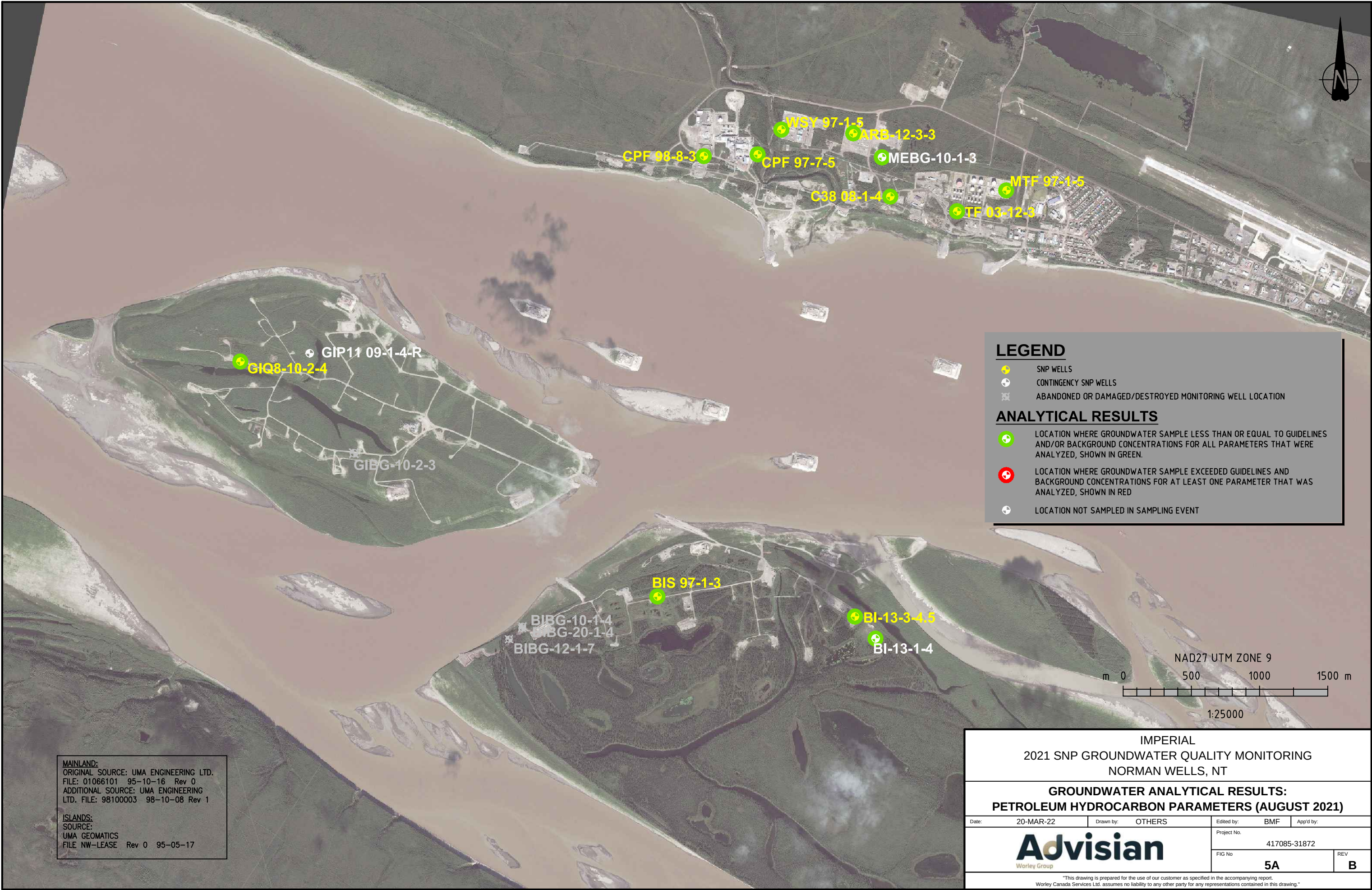
LOCATION WHERE GROUNDWATER SAMPLE LESS THAN OR EQUAL TO GUIDELINES AND/OR BACKGROUND CONCENTRATIONS FOR ALL PARAMETERS THAT WERE ANALYZED, SHOWN IN GREEN.

LOCATION WHERE GROUNDWATER SAMPLE EXCEEDED GUIDELINES AND BACKGROUND CONCENTRATIONS FOR AT LEAST ONE PARAMETER THAT WAS ANALYZED, SHOWN IN RED

LOCATION NOT SAMPLED IN SAMPLING EVENT

IMPERIAL							
2021 SNP GROUNDWATER QUALITY MONITORING							
NORMAN WELLS, NT							
GROUNDWATER ANALYTICAL RESULTS:							
DISSOLVED CHLORIDE (AUGUST 2021)							
Date:	20-MAR-22	Drawn by:	OTHERS	Edited by:	BMF	App'd by:	
				Project No.		417085-31872	
				FIG No		4A	
				REV		B	
"This drawing is prepared for the use of our customer as specified in the accompanying report. Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."							





MAINLAND:
ORIGINAL SOURCE: UMA ENGINEERING LTD.
FILE: 01066101 95-10-16 Rev 0
ADDITIONAL SOURCE: UMA ENGINEERING LTD.
FILE: 98100003 98-10-08 Rev 1

ISLANDS:
SOURCE:
UMA GEOMATICS
FILE NW-LEASE Rev 0 95-05-17

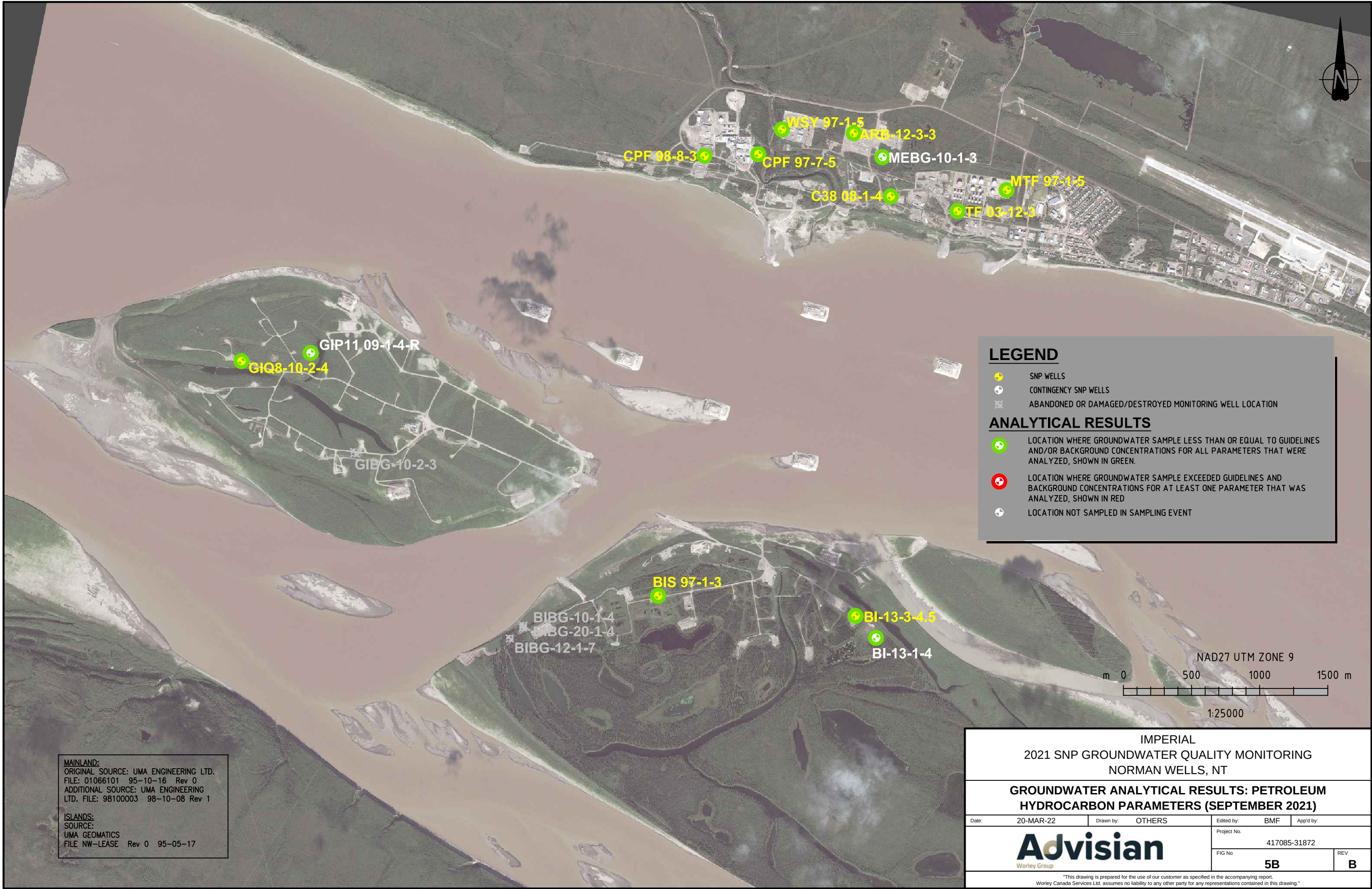
LEGEND

- SNP WELLS
- CONTINGENCY SNP WELLS
- ABANDONED OR DAMAGED/DESTROYED MONITORING WELL LOCATION

ANALYTICAL RESULTS

- LOCATION WHERE GROUNDWATER SAMPLE LESS THAN OR EQUAL TO GUIDELINES AND/OR BACKGROUND CONCENTRATIONS FOR ALL PARAMETERS THAT WERE ANALYZED, SHOWN IN GREEN.
- LOCATION WHERE GROUNDWATER SAMPLE EXCEEDED GUIDELINES AND BACKGROUND CONCENTRATIONS FOR AT LEAST ONE PARAMETER THAT WAS ANALYZED, SHOWN IN RED
- LOCATION NOT SAMPLED IN SAMPLING EVENT

IMPERIAL 2021 SNP GROUNDWATER QUALITY MONITORING NORMAN WELLS, NT					
GROUNDWATER ANALYTICAL RESULTS: PETROLEUM HYDROCARBON PARAMETERS (AUGUST 2021)					
Date:	20-MAR-22	Drawn by:	OTHERS	Edited by:	BMF
		App'd by:		Project No.	
				417085-31872	
			FIG No	5A	REV
			B		
This drawing is prepared for the use of our customer as specified in the accompanying report. Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing.					





Tables

Monitoring Well Installation Details: Datum/Groundwater Surface Elevations and Hydraulic Conductivities

PROJECT No.: 417085-31872																			
Monitoring Station	Status	Background Category	Easting (m)	Northing (m)	Ground Elevation (masl)	Datum Elevation (masl)	Surveyed Stickup (m)	Total Depth of Piezometer (mbgs)	Bottom of Piezometer Elevation (masl)	Depth Interval of Screen (mbgs)	Depth Interval of Sand (mbgs)	Date (dd-mmm-yyyy)	Depth to Groundwater (mbtoc)	Depth to Groundwater (mbgs)	Groundwater Surface Elevation (masl)	Measured Stick up (m)	Hydraulic Conductivity (m/s)	Lithology	Comments
Surveillance Network Program - Mainland Locations																			
ARB-12-3-3	Active	W-CAT-1	599801.144	7242007.048	65.33	66.02	0.69	2.70	62.63	1.20 - 2.70	0.80 - 2.70	07-Aug-2015	2.79	2.1	63.23	N/M	5.9e-006	Gravel fill/Sand/Peat	Replaced waterra with dedicated bailer
												14-Sep-2015	2.57	1.88	63.45	N/M			
												05-Aug-2016	2.71	2.02	63.31	N/M			
												02-Oct-2016	2.54	1.85	63.48	N/M			
												04-Nov-2016	2.79	2.1	63.23	N/M			
												12-Aug-2017	2.62	1.93	63.4	N/M			
												12-Sep-2017	2.45	1.76	63.57	N/M			
												11-Jul-2018	2.44	1.75	63.58	0.71			
												15-Sep-2018	2.48	1.79	63.54	N/M			
												11-Jul-2019	2.42	1.73	63.6	0.72			
												28-Sep-2019	2.53	1.84	63.49	N/M			
												23-Jul-2020	2.44	1.75	63.58	0.72			
												17-Sep-2020	2.4	1.71	63.62	N/M			
												20-Aug-2021	2.36	1.67	63.66	0.65			
C38 08-1-4	Active	W-CAT-1	600072.804	7241542.767	60.48	61.23	0.75	3.80	56.68	1.80 - 3.80	1.50 - 3.80	06-Aug-2015	1.82	1.07	59.41	N/M	5.9e-006	Sandy silt/peat/silty clay	Frost jacked
												14-Sep-2015	1.65	0.9	59.58	N/M			
												05-Aug-2016	1.92	1.17	59.31	N/M			
												02-Oct-2016	1.83	1.08	59.4	N/M			
												04-Nov-2016	2.17	1.42	59.06	N/M			
												12-Aug-2017	1.97	1.22	59.26	N/M			
												12-Sep-2017	1.74	0.99	59.49	N/M			
												13-Jul-2018	1.9	1.15	59.33	0.95			
												15-Sep-2018	1.97	1.22	59.26	N/M			
												15-Jul-2019	2.07	1.32	59.16	0.99			
												28-Sep-2019	2.09	1.34	59.14	N/M			
												23-Jul-2020	2.02	1.27	59.21	1.04			
												17-Sep-2020	2.01	1.26	59.22	N/M			
												20-Aug-2021	2.11	1.36	59.12	1			
CPF 97-7-5	Active	W-CAT-1	599100.347	7241852.827	58.64	59.49	0.84	4.90	53.87	N/A	1.20 - 4.90	15-Sep-2021	2.47	1.78	63.55	N/M	1.1e-008	Silt/siltstone	Well is frost-jacked
												07-Aug-2015	1.37	0.53	58.12	N/M			
												14-Sep-2015	1.42	0.58	58.07	N/M			
												06-Aug-2016	1.35	0.51	58.14	N/M			
												02-Oct-2016	1.76	0.92	57.73	N/M			
												04-Nov-2016	4.71	3.87	54.78	N/M			
												17-Aug-2017	1.25	0.41	58.24	N/M			
												12-Sep-2017	1.39	0.55	58.1	N/M			
												20-Jul-2018	1.43	0.59	58.06	0.97			
												15-Sep-2018	1.56	0.72	57.93	N/M			
												11-Jul-2019	> 5.88	> 5.04	< 53.61	N/M			
												26-Jul-2019	1.54	0.7	57.95	N/M			
												28-Sep-2019	2.04	1.2	57.45	N/M			
												23-Jul-2020	5.45	4.61	54.04	0.81			
CPF 98-8-3	Active	W-CAT-1	598705.553	7241839.552	58.79	59.54	0.75	2.70	55.95	1.40 - 2.90	0.80 - 2.90	17-Sep-2020	1.9	1.06	57.59	N/M	1.7e-006	Clay silt	dry
												20-Aug-2021	1.36	0.52	58.13	0.86			
												15-Sep-2021	1.94	1.1	57.55	N/M			
												07-Aug-2015	1.39	0.64	58.15	N/M			
												14-Sep-2015	1.27	0.52	58.27	N/M			
												06-Aug-2016	1.72	0.97	57.82	N/M			
												02-Oct-2016	1.35	0.6	58.19	N/M			
												04-Nov-2016	1.89	1.14	57.65	N/M			
												17-Aug-2017	1.66	0.91	57.88	N/M			
												12-Sep-2017	1.31	0.56	58.23	N/M			
												22-Jul-2018	1.53	0.78	58.01	1.09			
												16-Sep-2018	1.31	0.56	58.23	N/M			
												11-Jul-2019	1.49	0.74	58.05	N/M			
												28-Sep-2019	1.31	0.56	58.23	N/M			
MEBG-10-1-3	Active	W-CAT-1	600011.383	7241831.078	63.73	64.47	0.75	3.00	60.73	1.50 - 3.00	1.00 - 3.00	23-Jul-2020	1.31	0.56	58.23	1.01	9.012e-007	Silty Sand / Clayey Silt	
												17-Sep-2020	1.37	0.62	58.17	N/M			
												20-Aug-2021	1.47	0.72	58.07	1.04			
												15-Sep-2021	1.18	0.43	58.36	N/M			

Monitoring Well Installation Details: Datum/Groundwater Surface Elevations and Hydraulic Conductivities

PROJECT No.: 417085-31872																																		
Monitoring Station	Status	Background Category	Easting (m)	Northing (m)	Ground Elevation (masl)	Datum Elevation (masl)	Surveyed Stickup (m)	Total Depth of Piezometer (mbgs)	Bottom of Piezometer Elevation (masl)	Depth Interval of Screen (mbgs)	Depth Interval of Sand (mbgs)	Date (dd-mmm-yyyy)	Depth to Groundwater (mbtoc)	Depth to Groundwater (mbgs)	Groundwater Surface Elevation (masl)	Measured Stick up (m)	Hydraulic Conductivity (m/s)	Lithology	Comments															
MTF 97-1-5	Active	W-CAT-1	600924.768	7241588.497	63.49	64.39	0.91	4.70	58.76	1.70 - 4.70	1.10 - 4.70	04-Nov-2016	1.1	0.35	63.37	N/M	>1.0E-05	Silt	Dry															
												12-Aug-2017	1.02	0.27	63.45	N/M																		
												12-Sep-2017	0.92	0.17	63.55	N/M																		
												16-Jul-2018	0.96	0.21	63.51	0.82																		
												15-Sep-2018	0.93	0.18	63.54	N/M																		
												15-Jul-2019	1	0.25	63.47	0.8																		
												04-Oct-2019	0.99	0.24	63.48	N/M																		
												23-Jul-2020	0.98	0.23	63.49	0.78																		
												17-Sep-2020	1.01	0.26	63.46	N/M																		
												20-Aug-2021	1.08	0.33	63.39	0.88																		
												15-Sep-2021	1.14	0.39	63.33	N/M																		
												08-Aug-2015	4.21	3.3	60.18	N/M																		
												15-Sep-2015	4.04	3.13	60.35	N/M																		
												02-Oct-2016	4.36	3.45	60.03	N/M																		
												TF 03-12-3	Active	W-CAT-1	600562.552	7241435.321				57.08	58.63	1.55	2.80	54.28	1.00 - 2.80	0.90 - 2.90	04-Nov-2016	> 5.61	> 4.70	< 58.79	N/M	>1.0E-05	Silty clay and shale fill	Frost jacked 15cm Frost jacked
17-Aug-2017	4.3	3.39	60.09	N/M																														
14-Sep-2017	4.13	3.22	60.26	N/M																														
16-Jul-2018	4.25	3.34	60.14	1.05																														
16-Sep-2018	4.14	3.24	60.25	N/M																														
18-Jun-2019	4.63	3.72	59.76	N/M																														
28-Sep-2019	4.28	3.37	60.11	N/M																														
23-Jul-2020	4.13	3.22	60.26	1.08																														
17-Sep-2020	4.24	3.33	60.15	N/M																														
20-Aug-2021	4.25	3.34	60.14	1.04																														
15-Sep-2021	4.38	3.47	60.01	N/M																														
08-Aug-2015	1.74	0.19	56.89	N/M																														
15-Sep-2015	1.74	0.19	56.89	N/M																														
06-Aug-2016	1.78	0.23	56.85	N/M																														
WSY 97-1-5	Active	W-CAT-1	599274.168	7242034.279	62.61	63.40	0.79	4.70	57.96	1.70 - 4.70	1.10 - 4.70						02-Oct-2016	1.78	0.23								56.85	N/M	1.7e-007	Silt	Frost jacked, cannot lock piezo Frost jacked, cannot lock piezo Frost jacked Frost jacked, cannot close red casing Well bent downhole, hard to get bailer down			
												04-Nov-2016	1.87	0.32	56.76	N/M																		
												17-Aug-2017	1.72	0.17	56.91	N/M																		
												13-Sep-2017	1.73	0.18	56.9	N/M																		
												16-Jul-2018	1.82	0.27	56.81	1.01																		
												16-Sep-2018	1.77	0.22	56.86	N/M																		
												18-Jun-2019	1.75	0.2	56.88	N/M																		
												28-Sep-2019	1.84	0.29	56.79	N/M																		
												23-Jul-2020	1.85	0.3	56.78	1																		
												17-Sep-2020	1.88	0.33	56.75	N/M																		
												20-Aug-2021	1.84	0.29	56.79	1.04																		
												15-Sep-2021	1.97	0.42	56.66	N/M																		
												06-Aug-2015	4.26	3.47	59.14	N/M																		
												14-Sep-2015	4.12	3.33	59.28	N/M																		
												05-Aug-2016	5.24	4.45	58.16	N/M																		
Surveillance Network Program - Bear Island Locations																																		
BI-13-1-4	Active	W-CAT-2	599964.584	7238301.752	49.70	49.70	0.00	N/A	N/A	1.30 - 4.30	1.00 - 4.60	07-Aug-2015	1.02	1.02	48.68	N/M	2.60E-06		casing loose															
												07-Aug-2016	1.13	1.13	48.57	N/M																		
												15-Aug-2017	1.3	1.3	48.4	N/M																		
												22-Nov-2017	1.89	1.89	47.81	N/M																		
												18-Jul-2018	1.08	1.08	48.62	1.09																		
												20-Sep-2018	1	1	48.7	N/M																		
												12-Jul-2019	1.15	1.15	48.55	1.21																		
												29-Sep-2019	1.05	1.05	48.65	N/M																		
												26-Jul-2020	1.03	1.03	48.67	1.02																		
												16-Sep-2020	1.07	1.07	48.63	N/M																		
												18-Sep-2021	1.36	1.36	48.34	N/M																		
												Partially blocked at 2.0 mbtoc																						

\\Worley.com\CA\Data\CAL\GBS\417085-31872\21100 - SNP GW Sampling\02_Rpts\11_TechRpts&Studies\03_Backend\2021 SNP Report\2021 Tables\Table 1_Water Levels_SNP_RevA-LG markup-SB revision

Monitoring Well Installation Details: Datum/Groundwater Surface Elevations and Hydraulic Conductivities

PROJECT No.: 417085-31872																			
Monitoring Station	Status	Background Category	Easting (m)	Northing (m)	Ground Elevation (masl)	Datum Elevation (masl)	Surveyed Stickup (m)	Total Depth of Piezometer (mbgs)	Bottom of Piezometer Elevation (masl)	Depth Interval of Screen (mbgs)	Depth Interval of Sand (mbgs)	Date (dd-mmm-yyyy)	Depth to Groundwater (mbtoc)	Depth to Groundwater (mbgs)	Groundwater Surface Elevation (masl)	Measured Stick up (m)	Hydraulic Conductivity (m/s)	Lithology	Comments
GIQ8-10-2-4	Active	W-CAT-2	595306.125	7240333.425	47.50	47.72	0.22	3.95	43.55	0.95 - 3.95	0.75 - 3.70	16-Sep-2020 17-Sep-2021 10-Aug-2015 16-Sep-2015 07-Aug-2016 02-Oct-2016 04-Nov-2016 20-Aug-2017 12-Sep-2017 14-Jul-2018 20-Sep-2018 16-Jul-2019 30-Sep-2019 25-Jul-2020 16-Sep-2020 21-Aug-2021 17-Sep-2021	3.09 3.08 > 5.67 2.11 1.72 2.48 2.66 2.43 2.25 2.53 2.21 2.63 2.6 2.44 2.31 2.31 2.39	2.99 [¥] 2.98 [¥] > 5.45 1.89 1.5 2.26 2.44 2.21 2.03 2.31 1.99 2.41 2.38 2.22 2.09 2.09 2.17	N/A N/A < 42.05 45.61 46 45.24 45.06 45.29 45.47 45.19 45.51 45.09 45.12 45.28 45.41 45.41 45.33	N/M N/M N/M N/M N/M N/M N/M N/M N/M 0.1 N/M 0.1 N/M 0.1 N/M N/M 0.11 N/M	3.3e-006	Sandy Silt	Dry

- NOTES:**
- 1. Data may be entered to the nearest mm, but are reported above to the nearest cm.
Apparent rounding errors may occasionally occur in calculated fields (e.g. Groundwater Surface Elevation).
 - 2. All coordinates are provided in the UTM Zone 9N referenced to North American Datum of 1927 coordinate system.
 - 3. N/M - Denotes not measured.
 - 4. N/A - Denotes not available.
 - 5. masl - Denotes metres above sea level.
 - 6. mbgs - Denotes metres below ground surface.
 - 7. mbtoc - Denotes metres below top of PVC casing.
 - 8. ¥ - depth to groundwater (mbgs) calculated using field-measured stick up, not used to calculate groundwater surface elevation
 - 9. Where a measurement is not available due to the source being dry, depths are displayed as greater than the measured depth of well, where available, and where not the installed depth is used.

Groundwater Analytical Results: Primary Indicator Parameters

PROJECT No.: 417085-31872				Chloride	Petroleum Hydrocarbons			
Sampling Location	Date	Status	Background Category	Chloride	Benzene	Toluene	Ethylbenzene	Xylenes (Total)
(dd-mmm-yyyy)				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
CCME CEQG Freshwater Aquatic Life				120	0.37	0.002	0.09	---
W-CAT-1				17	0.0005	0.0005	0.0005	0.000923
W-CAT-2				23	0.0004	0.0004	0.0004	0.00089
Surveillance Network Program - Mainland Locations								
ARB-12-3-3	07-Aug-2015	Active	W-CAT-1	16	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	14-Sep-2015			8.7	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	05-Aug-2016			19	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	02-Oct-2016			12	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	12-Aug-2017			12	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	12-Sep-2017			22	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	11-Jul-2018			27	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2018			16	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	11-Jul-2019			26	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	28-Sep-2019			17	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	23-Jul-2020			11	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	17-Sep-2020			7.0	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	20-Aug-2021			7.1	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2021			11	< 0.00040	< 0.00040	< 0.00040	< 0.00089
C38 08-1-4	06-Aug-2015	Active	W-CAT-1	19	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	14-Sep-2015			20	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	05-Aug-2016			23	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	02-Oct-2016			21	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	12-Aug-2017			19	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	12-Sep-2017			14	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	13-Jul-2018			21	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	16-Sep-2018			18	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Jul-2019			18	0.00093	< 0.00040	< 0.00040	< 0.00089
	28-Sep-2019			19	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	23-Jul-2020			20	0.00048	< 0.00040	< 0.00040	< 0.00089
	17-Sep-2020			17	0.00060	< 0.00040	< 0.00040	< 0.00089
	20-Aug-2021			16	0.00058	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2021			16	0.00053	< 0.00040	< 0.00040	< 0.00089
CPF 97-7-5	07-Aug-2015	Active	W-CAT-1	11	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	14-Sep-2015			11	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	06-Aug-2016			22	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	02-Oct-2016			23	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	17-Aug-2017			19	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	12-Sep-2017			18	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	20-Jul-2018			16	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2018			15	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	27-Jul-2019			16	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	28-Sep-2019			74	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	23-Jul-2020			15	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	17-Sep-2020			11	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	20-Aug-2021			8.4	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2021			9.9	< 0.00040	< 0.00040	< 0.00040	< 0.00089
CPF 98-8-3	07-Aug-2015	Active	W-CAT-1	7.1	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	14-Sep-2015			8.7	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	06-Aug-2016			13	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	02-Oct-2016			12	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	17-Aug-2017			9.4	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	12-Sep-2017			9.1	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	22-Jul-2018			6.8	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	16-Sep-2018			8.5	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	11-Jul-2019			6.8	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	28-Sep-2019			9.7	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	23-Jul-2020			7.4	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	17-Sep-2020			9.0	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	20-Aug-2021			6.6	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2021			8.3	< 0.00040	< 0.00040	< 0.00040	< 0.00089
MEBG-10-1-3	06-Aug-2015	Active	W-CAT-1	3.0	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	14-Sep-2015			2.4	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	03-Aug-2016			2.2	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	02-Oct-2016			2.3	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	12-Aug-2017			2.4	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	12-Sep-2017			2.4	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	16-Jul-2018			1.9	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2018			2.3	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Jul-2019			2.0	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	04-Oct-2019			1.9	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	23-Jul-2020			1.7	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	17-Sep-2020			2.2	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	20-Aug-2021			< 2.0 ^{#1}	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2021			3.4	< 0.00040	< 0.00040	< 0.00040	< 0.00089
MTF 97-1-5	08-Aug-2015	Active	W-CAT-1	1.2	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	15-Sep-2015			< 1.0	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	03-Oct-2016			1.2	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	17-Aug-2017			1.5	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	14-Sep-2017			1.0	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	16-Jul-2018			1.9	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	16-Sep-2018			< 1.0	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	18-Jun-2019			< 1.0	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	28-Sep-2019			1.7	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	23-Jul-2020			1.4	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	19-Sep-2020			1.5	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	20-Aug-2021			1.3	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2021			1.4	< 0.00040	< 0.00040	< 0.00040	< 0.00089
TF 03-12-3	08-Aug-2015	Active	W-CAT-1	140	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	15-Sep-2015			140	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	06-Aug-2016			130	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	02-Oct-2016			120	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	17-Aug-2017			160	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	13-Sep-2017			190	< 0.00040	< 0.00040	< 0.00040	< 0.00080
	16-Jul-2018			170	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	16-Sep-2018			110	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	19-Jun-2019			110	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	28-Sep-2019			80	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	23-Jul-2020			99	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	19-Sep-2020			100	< 0.00040	< 0.00040	< 0.00040	< 0.00089

Groundwater Analytical Results: Primary Indicator Parameters

PROJECT No.: 417085-31872				Chloride	Petroleum Hydrocarbons						
Sampling Location (dd-mmm-yyyy)	Date	Status	Background Category	Chloride (mg/L)	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (Total) (mg/L)			
CCME CEQG Freshwater Aquatic Life				120	0.37	0.002	0.09	---			
W-CAT-1				17	0.0005	0.0005	0.0005	0.000923			
W-CAT-2				23	0.0004	0.0004	0.0004	0.00089			
WSY 97-1-5	20-Aug-2021	Active	W-CAT-1	84	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	15-Sep-2021			72	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	06-Aug-2015			14	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	14-Sep-2015			13	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	05-Aug-2016			11	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	03-Oct-2016			6.5	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	18-Aug-2017			15	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	12-Sep-2017			26	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	11-Jul-2018			24	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	18-Sep-2018			---	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	15-Jul-2019			23	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	28-Sep-2019			24	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	23-Jul-2020			40	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	17-Sep-2020			26	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	20-Aug-2021			33	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	15-Sep-2021			---	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
Surveillance Network Program - Bear Island Locations											
BI-13-1-4	07-Aug-2015	Active	W-CAT-2	7.7	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	07-Aug-2016			7.9	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	15-Aug-2017			6.2	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	18-Jul-2018			4.6	---	---	---	---			
	20-Sep-2018			8.3	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	12-Jul-2019			2.5	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	29-Sep-2019			8.7	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	26-Jul-2020			3.1	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	16-Sep-2020			8.5	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	22-Aug-2021			5.3	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	18-Sep-2021			11	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	BI-13-3-4.5			07-Aug-2015	Active	W-CAT-2	11	< 0.00040	< 0.00040	< 0.00040	< 0.00080
				08-Aug-2016			8.5	0.00042	< 0.00040	< 0.00040	< 0.00080
15-Aug-2017		8.7	< 0.00040	< 0.00040			< 0.00040	< 0.00080			
22-Nov-2017		6.5	< 0.00040	< 0.00040			< 0.00040	< 0.00080			
18-Jul-2018		7.2	< 0.00040	< 0.00040			< 0.00040	< 0.00089			
20-Sep-2018		10	< 0.00040	< 0.00040			< 0.00040	< 0.00089			
12-Jul-2019		8.4	< 0.00040	< 0.00040			< 0.00040	< 0.00089			
26-Jul-2020		6.0	< 0.00040	< 0.00040			< 0.00040	< 0.00089			
16-Sep-2020		7.1	< 0.00040	< 0.00040			< 0.00040	< 0.00089			
21-Aug-2021		6.0	< 0.00040	< 0.00040			< 0.00040	< 0.00089			
BIBG-10-1-4	09-Aug-2015	Damaged	W-CAT-2	12	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	10-Aug-2016			25	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	11-Aug-2017			18	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	17-Jul-2018			16	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	20-Sep-2018			23	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	17-Jul-2019			23	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
BIBG-12-1-7	29-Sep-2019	Active	W-CAT-2	20	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	26-Jul-2020			22	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	09-Aug-2015			8.1	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
BIS 97-1-3	07-Aug-2016	Active	W-CAT-2	7.5	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	22-Nov-2017			20	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
WSY 97-1-5	20-Jul-2018	Active	W-CAT-2	16	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	20-Sep-2018			22	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	17-Jul-2019			19	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	29-Sep-2019			22	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	26-Jul-2020			18	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	16-Sep-2020			19	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	21-Aug-2021			20	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	18-Sep-2021			23	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	Surveillance Network Program - Goose Island Locations										
GIBG-10-2-3	10-Aug-2015	Active	W-CAT-2	1.9	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	16-Sep-2015			3.1	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	07-Aug-2016			< 1.0	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	03-Oct-2016			2.3	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	20-Aug-2017			2.4	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	12-Sep-2017			2.9	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	14-Jul-2018			6.9	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	20-Sep-2018			6.9	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	16-Jul-2019			9.9	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	30-Sep-2019			11	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	25-Jul-2020			5.3	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	16-Sep-2020			5.4	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
GIP11 09-1-4	10-Aug-2015	Replaced	W-CAT-2	4.5	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	16-Sep-2015			6.3	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
GIP11 09-1-4-R	14-Jul-2018	Active	W-CAT-2	50	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	20-Sep-2018			14	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	16-Jul-2019			14	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	04-Oct-2019			17	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	25-Jul-2020			5.9	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	16-Sep-2020			5.0	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
GIQ8-10-2-4	17-Sep-2021	Active	W-CAT-2	5.4	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	16-Sep-2015			20	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	07-Aug-2016			14	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	03-Oct-2016			18	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	20-Aug-2017			5.8	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	12-Sep-2017			9.4	< 0.00040	< 0.00040	< 0.00040	< 0.00080			
	14-Jul-2018			21	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	20-Sep-2018			21	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	16-Jul-2019			20	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
	30-Sep-2019			20	< 0.00040	< 0.00040	< 0.00040	< 0.00089			
25-Jul-2020	6.9	< 0.00040	< 0.00040	< 0.00040	< 0.00089						
16-Sep-2020	19	< 0.00040	< 0.00040	< 0.00040	< 0.00089						
21-Aug-2021	21	< 0.00040	< 0.00040	< 0.00040	0.0016						
17-Sep-2021	21	< 0.00040	< 0.00040	< 0.00040	< 0.00089						

Groundwater Analytical Results: Primary Indicator Parameters

PROJECT No.: 417085-31872				Chloride	Petroleum Hydrocarbons			
Sampling Location	Date (dd-mmm-yyyy)	Status	Background Category	Chloride				
				(mg/L)	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (Total) (mg/L)
CCME CEQG Freshwater Aquatic Life				120	0.37	0.002	0.09	---
W-CAT-1				17	0.0005	0.0005	0.0005	0.000923
W-CAT-2				23	0.0004	0.0004	0.0004	0.00089

Relative Percent Difference (RPD) Report								
CPF 97-7-5 (Duplicate)	20-Aug-2021	Active	W-CAT-1	8.4	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	20-Aug-2021			---	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	RPD(%)			---	---	---	---	---
TF 03-12-3 (Duplicate)	15-Sep-2021	Active	W-CAT-1	72	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2021			76	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	RPD(%)			5.6%	---	---	---	---
MEBG-10-1-3 (Duplicate)	20-Aug-2021	Active	W-CAT-1	< 2.0 ^{#1}	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	20-Aug-2021			---	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	RPD(%)			---	---	---	---	---
CPF 98-8-3 (Duplicate)	15-Sep-2021	Active	W-CAT-1	8.3	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	15-Sep-2021			8.1	< 0.00040	< 0.00040	< 0.00040	< 0.00089
	RPD(%)			2.5%	---	---	---	---

NOTES:

1. --- in guideline row(s) denotes no criteria for that parameter.
2. --- in detail data row(s) denotes parameter not analyzed.
- Bold

3. Denotes values exceeding applied background concentrations and CCME guideline (CCME 2019. Canadian Environmental Quality Guidelines Summary Table 1. <http://st-ts.ccme.ca/?chems=all&chapters=1> accessed Feb, 2019).
- Bold

4. Denotes values exceeding applied background concentrations only.
- Bold

5. Denotes non-detect values where reportable detection limit exceeds applicable background guideline (CCME 2019. Canadian Environmental Quality Guidelines Summary Table 1. <http://st-ts.ccme.ca/?chems=all&chapters=1> accessed Feb, 2022).
- Chloride:
Guideline based on chronic exposure
6. Superscript ^{#1} - Detection limits raised due to sample matrix.
- Bold

7. Relative percent difference exceeds applicable alert limit of 50% for chloride concentration.
8. Background 95th Percentile Statistical Category:
W-CAT-1: Mainland Locations - Surficial Sediments - 95th Percentile E
W-CAT-2: Bear, Goose, and Frenchy's Islands - Surficial Sediments -



Appendix A

Limitation of Liability, Scope of Report, and Third-Party Reliance

Limitation of Liability, Scope of Report, and Third-Party Reliance

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The investigation undertaken by Advisian with respect to this report and any conclusions or recommendations made in this report reflect Advisian's judgment based on the site conditions observed at the time of the site inspection on the date(s) set out in this report and on information available at the time of preparation of this report. This report has been prepared for the specific application to this site and it is based, in part, upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site, substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken.

If site conditions or applicable standards change or if any additional information becomes available at a future date, modifications to the findings, conclusions, and recommendations in this report may be necessary.

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Appendix B

Background Geochemical Statistical Summary

Table B-1

Groundwater Indicator Parameters - Background Geochemical Statistical Summary (1997-2019)

PROJECT No.: 417085-31872

Monitoring Station		Bicarbonate (mg/L)	Calcium (mg/L)	Carbonate (CO ₃) (mg/L)	Chloride (mg/L)	Electrical Conductivity (uS/cm)	Hardness (as CaCO ₃) (mg/L)	Hydroxide (mg/L)	Nitrate (as N) (mg/L)	Nitrite (as N) (mg/L)	pH (pH units)	Phenols (mg/L)	Potassium (mg/L)	PP Alkalinity (as CaCO ₃) (mg/L)	Sodium (mg/L)	Sulphate (mg/L)	Total Dissolved Solids (mg/L)
CCME 2015, CEQG Freshwater Aquatic Life		---	---	---	120	---	---	---	3	0.06	(6.5 - 9)	0.004	---	---	---	---	---
Background - Surficial Sediments																	
W-CAT-1	Mainland Locations - Surficial Sediments - 95th Percentile Background	1000	312	1	17	2300	1241	1	0.4	0.03	8.1	0.013	5.2	1.0	161	700	1620
	Mainland Locations - Surficial Sediments - Maximum Background	1100	400	5	26	2800	1600	5	36.0	0.11	8.1	0.021	12.0	5.0	180	980	2200
W-CAT-2	Bear, Goose, and Frenchy's Islands - Surficial Sediments - 95th Percentile Background	975	477	1	23	2600	1600	1	2.4	0.03	8.0	0.014	4.5	1.0	100	930	2255
	Bear, Goose, and Frenchy's Islands - Surficial Sediments - Maximum Background	1200	540	1	25	3000	1800	1	23.0	0.17	8.1	0.048	5.3	1.0	520	1200	2700
Background - Shallow Bedrock - Inferred to Represent Natural Saline Water & Hydrocarbon Seepage																	
W-CAT-3	Shallow Bedrock - Natural Saline Water & Oil Seepage - 95th Percentile Background	1570	198	25	715	3397	788	0.5	1.0	0.06	8.5	0.020	7.6	20.5	747	117	2402
	Shallow Bedrock - Natural Saline Water & Oil Seepage - Maximum Background	1680	474	40	1500	5880	1580	1	4.0	0.26	8.6	0.025	16.8	33.0	848	185	3130
Background - Surficial Sediments - Inferred to Represent Natural Saline Water & Hydrocarbon Seepage																	
W-CAT-4	Surficial Sediments - Natural Saline Water & Oil Seepage - 95th Percentile Background	1220	350	62	280	2780	1200	1	0.2	0.06	8.7	0.020	7.5	51.0	440	990	2015
	Surficial Sediments - Natural Saline Water & Oil Seepage - Maximum Background	1300	390	200	291	2800	1300	1	0.4	0.06	10.1	0.023	8.6	160	680	1000	2300
Background - Surficial Sediments - Inferred to Represent Natural Gas Seepage without Saline Water																	
W-CAT-5	Surficial Sediments - Natural Gas & Non-Saline Water Seepage - 95th Percentile Background	876	266	1	12	1384	740	1	0.2	0.06	7.7	0.062	6.9	1.0	47	201	920
	Surficial Sediments - Natural Gas & Non-Saline Water Seepage - Maximum Background	950	330	1	13	1600	750	1	0.2	0.10	7.9	0.072	10.0	1.0	72	330	1200

NA Denotes guideline not available

NC Denotes parameters not measured / not calculated

Shading indicates parameters above most restrictive guidelines selected



Appendix C
Field Methodologies

Groundwater Sampling Methods

Field Measurements, Sampling and Handling

Prior to collection of groundwater samples, the water and/or hydrocarbon level was measured from the top of the piezometer casing using a commercially-available electric water level meter.

Subsequently, groundwater from each monitoring well was collected for field measurements and laboratory analyses, using either dedicated or disposable bailers with no-purge methodology for the following primary indicator analyses per the GMP:

Dissolved Chloride: 1 x 500 mL aliquot (unfiltered and chemically unpreserved) for analysis of major ions.

BTEX: 3 x 44 mL aliquots (placed in glass vials containing NaHSO_4 preservative, no headspace) for analysis of BTEX compounds (benzene, toluene, ethylbenzene and xylenes).

Additional samples were collected for analysis of secondary indicator parameters as per the GMP. Upon completion of sampling at each location, all equipment was thoroughly rinsed with deionized water. New bailing rope (as required) and clean disposable nitrile gloves were used at each piezometer to reduce the potential for cross-contamination. Samples were stored in iced coolers to maintain approximate in situ temperatures, and were promptly shipped to Bureau Veritas in Edmonton, Alberta. Standard chain-of-custody procedures were followed.



Appendix D

Laboratory Analytical Reports

DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 20-Aug-21

Location: Norman Wells

Laboratory : Bureau Veritas

Consultant Project Number: 417085-31872.21100

Sample Submission Number: C161381

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Instrument Surrogate Recovery	x			Matrix spike recovery of Dissolved Zinc (Zn) (68%) did not meet acceptance criteria (80-120%) for sample A329931. Laboratory control sample recovery of Dissolved Zinc (Zn) (129%) did not meet acceptance criteria (80-120%) for sample Spiked Blank A329913. All other laboratory QC met acceptance criteria.
Extraction Surrogate Recovery	x			
Method Blank Concentration	x			
Matrix Duplicate RPD	x			
Matrix Spike Recovery		x		
Lab Control Sample Recovery		x		

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Field Blank Concentration			x	All field QC samples met alert limits.
Trip Blank Concentration			x	
Equipment Blank Concentration			x	
Field Duplicate RPD	x			

Has CoA been signed off (Yes/No)?:

Yes

Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?:

Yes

Were all samples analyzed within hold times (Yes/No)?:

Yes

All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?:

n/a

Is Chain of Custody completed and signed (Yes/No)?:

Yes

Were sample temperatures acceptable when they reached lab (Yes/No)?:

Yes

Was a Data Quality Overview (DQO) issued (Yes/No)?:

Yes

Date DQO was received: 30-Aug-21

Is data considered to be reliable (Yes/No)?:

Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Nandhini Durairaj

Date: 16-Sep-21

Data Reviewed by (Signature):

D. Nandhini.

**Attention: Alex Haigh**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100
Your C.O.C. #: 299501

Report Date: 2021/08/30
Report #: R3065259
Version: 1 - Final

CERTIFICATE OF ANALYSIS**BV LABS JOB #: C161381****Received: 2021/08/23, 15:00**

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	4	AB SOP-00005	SM 23 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	5	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	5		Auto Calc
Cadmium - low level CCME - Dissolved	4		Auto Calc
Chloride/Sulphate by Auto Colourimetry	4	AB SOP-00020	SM23-4500-Cl/SO ₄ -E m
Conductivity @25C	4	AB SOP-00005	SM 23 2510 B m
Fluoride	4	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons in Water (F2; C10-C16) (1)	5	AB SOP-00037 AB SOP-00040	CCME PHC-CWS m
Hardness	4		Auto Calc
Mercury (Dissolved) by CV (2)	4	AB SOP-00084	BCMOE BCLM Oct2013 m
Elements by ICP - Dissolved (2)	4	AB SOP-00042	EPA 6010d R5 m
Elements by ICPMS - Dissolved (2)	4	AB SOP-00043	EPA 6020b R2 m
Ion Balance	4		Auto Calc
Nitrate and Nitrite	4		Auto Calc
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	4	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	4		Auto Calc
Phenols (4-AAP)	4	AB SOP-00088	EPA 9066 R0 m
Total Dissolved Solids (Filt. Residue)	4	AB SOP-00065	SM 23 2540 C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless



Attention: Alex Haigh

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100
Your C.O.C. #: 299501

Report Date: 2021/08/30
Report #: R3065259
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C161381

Received: 2021/08/23, 15:00

otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Silica gel clean up employed.

(2) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Rhécie Phayouphone
Key Account Specialist
30 Aug 2021 17:25:20

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Namita Sahni, Customer Solutions Representative

Email: Namita.Sahni@bureauveritas.com

Phone# (604)639-2614

=====

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BUREAU
VERITASBV Labs Job #: C161381
Report Date: 2021/08/30

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

AT1 BTEX AND F1-F2 IN WATER (WATER)

BV Labs ID		AEH913	AEH914	AEH915	AEH916	AEH917		
Sampling Date		2021/08/20 13:20	2021/08/20 12:26	2021/08/20 15:42	2021/08/20 14:30	2021/08/20 12:26		
COC Number		299501	299501	299501	299501	299501		
	UNITS	CPF 98-8-3	CPF 97-7-5	C38 08-1-4	WSY 97-1-5	SNP-21-DUP1	RDL	QC Batch
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A329499
Volatiles								
Benzene	mg/L	<0.00040	<0.00040	0.00058	<0.00040	<0.00040	0.00040	A329773
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A329773
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A329773
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	A329773
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A329773
Xylenes (Total)	mg/L	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	0.00089	A329022
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A329022
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A329773
Extraction Surrogate Recovery (%)								
O-TERPHENYL (sur.)	%	103	101	103	102	102		A329499
Instrument Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	100	98	98	97	97		A329773
4-Bromofluorobenzene (sur.)	%	105	102	107	101	101		A329773
D4-1,2-Dichloroethane (sur.)	%	95	94	96	91	93		A329773
RDL = Reportable Detection Limit								

BV Labs ID		AEH917		
Sampling Date		2021/08/20 12:26		
COC Number		299501		
	UNITS	SNP-21-DUP1 Lab-Dup	RDL	QC Batch
Ext. Pet. Hydrocarbon				
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	0.10	A329499
Extraction Surrogate Recovery (%)				
O-TERPHENYL (sur.)	%	101		A329499
RDL = Reportable Detection Limit				
Lab-Dup = Laboratory Initiated Duplicate				



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BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AEH913			AEH914			AEH915		
Sampling Date		2021/08/20 13:20			2021/08/20 12:26			2021/08/20 15:42		
COC Number		299501			299501			299501		
	UNITS	CPF 98-8-3	RDL	QC Batch	CPF 97-7-5	RDL	QC Batch	C38 08-1-4	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO ₃)	mg/L	550	0.50	A329079	1400	0.50	A329079	560	0.50	A329079
Ion Balance (% Difference)	%	3.2	N/A	A329060	4.8	N/A	A329060	1.1	N/A	A329060
Dissolved Nitrate (N)	mg/L	<0.010	0.010	A328004	0.20	0.010	A328004	<0.050	0.050	A328004
Dissolved Nitrate (NO ₃)	mg/L	<0.044	0.044	A328003	0.88	0.044	A328003	<0.22	0.22	A329080
Dissolved Nitrite (NO ₂)	mg/L	<0.033	0.033	A328003	<0.033	0.033	A328003	<0.16	0.16	A329080
Elements										
Dissolved Cadmium (Cd)	mg/L	0.000034	0.000020	A328990	0.00044	0.000020	A328990	<0.000020	0.000020	A328990
Misc. Inorganics										
Conductivity	uS/cm	1100	2.0	A329970	2100	2.0	A329970	1200	2.0	A329970
Total Dissolved Solids	mg/L	690 (1)	13	A332798	1800	10	A332798	600 (1)	25	A332798
Anions										
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A329964	<1.0	1.0	A329964	<1.0	1.0	A329964
Alkalinity (Total as CaCO ₃)	mg/L	410	1.0	A329964	220	1.0	A329964	640	1.0	A329964
Bicarbonate (HCO ₃)	mg/L	500	1.0	A329964	270	1.0	A329964	780	1.0	A329964
Carbonate (CO ₃)	mg/L	<1.0	1.0	A329964	<1.0	1.0	A329964	<1.0	1.0	A329964
Dissolved Fluoride (F)	mg/L	0.058	0.050	A329971	0.076	0.050	A329971	0.086	0.050	A329971
Hydroxide (OH)	mg/L	<1.0	1.0	A329964	<1.0	1.0	A329964	<1.0	1.0	A329964
Dissolved Chloride (Cl)	mg/L	6.6	1.0	A331998	8.4	1.0	A331998	16	1.0	A331998
Dissolved Sulphate (SO ₄)	mg/L	190	1.0	A331998	1100	10	A331998	<1.0	1.0	A331998
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A328793	<0.010	0.010	A329208	<0.050 (2)	0.050	A328793
Dissolved Nitrate plus Nitrite (N)	mg/L	<0.010	0.010	A328793	0.20	0.010	A329208	<0.010	0.010	A328793
Misc. Organics										
Phenols	mg/L	<0.0015	0.0015	A330852	<0.0015	0.0015	A330852	0.0024	0.0015	A330852

RDL = Reportable Detection Limit

N/A = Not Applicable

(1) Detection limit raised based on sample volume used for analysis.

(2) Detection limits raised due to matrix interference.



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BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AEH916		
Sampling Date		2021/08/20 14:30		
COC Number		299501		
	UNITS	WSY 97-1-5	RDL	QC Batch
Calculated Parameters				
Hardness (CaCO ₃)	mg/L	970	0.50	A329079
Ion Balance (% Difference)	%	0.083	N/A	A329060
Dissolved Nitrate (N)	mg/L	0.095	0.010	A328004
Dissolved Nitrate (NO ₃)	mg/L	0.42	0.044	A329080
Dissolved Nitrite (NO ₂)	mg/L	0.033	0.033	A329080
Elements				
Dissolved Cadmium (Cd)	mg/L	0.00013	0.000020	A328990
Misc. Inorganics				
Conductivity	uS/cm	1600	2.0	A329970
Total Dissolved Solids	mg/L	1300	10	A332798
Anions				
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A329964
Alkalinity (Total as CaCO ₃)	mg/L	370	1.0	A329964
Bicarbonate (HCO ₃)	mg/L	460	1.0	A329964
Carbonate (CO ₃)	mg/L	<1.0	1.0	A329964
Dissolved Fluoride (F)	mg/L	0.096	0.050	A329971
Hydroxide (OH)	mg/L	<1.0	1.0	A329964
Dissolved Chloride (Cl)	mg/L	33	1.0	A331999
Dissolved Sulphate (SO ₄)	mg/L	550	5.0	A331999
Nutrients				
Dissolved Nitrite (N)	mg/L	0.010	0.010	A328793
Dissolved Nitrate plus Nitrite (N)	mg/L	0.10	0.010	A328793
Misc. Organics				
Phenols	mg/L	<0.0015	0.0015	A330852
RDL = Reportable Detection Limit N/A = Not Applicable				



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BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

MERCURY BY COLD VAPOR (WATER)

BV Labs ID		AEH913	AEH914	AEH915	AEH916		
Sampling Date		2021/08/20 13:20	2021/08/20 12:26	2021/08/20 15:42	2021/08/20 14:30		
COC Number		299501	299501	299501	299501		
	UNITS	CPF 98-8-3	CPF 97-7-5	C38 08-1-4	WSY 97-1-5	RDL	QC Batch
Elements							
Dissolved Mercury (Hg)	ug/L	<0.0019	<0.0019	<0.0019	<0.0019	0.0019	A336034
RDL = Reportable Detection Limit							



BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AEH913	AEH914			AEH914		
Sampling Date		2021/08/20 13:20	2021/08/20 12:26			2021/08/20 12:26		
COC Number		299501	299501			299501		
	UNITS	CPF 98-8-3	CPF 97-7-5	RDL	QC Batch	CPF 97-7-5 Lab-Dup	RDL	QC Batch
Elements								
Dissolved Aluminum (Al)	mg/L	0.044	0.035	0.0030	A329931	0.029	0.0030	A329931
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00085	0.00060	A329931	0.00074	0.00060	A329931
Dissolved Arsenic (As)	mg/L	0.00025	<0.00020	0.00020	A329931	<0.00020	0.00020	A329931
Dissolved Barium (Ba)	mg/L	0.18	0.071	0.010	A331733			
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010	A329931	<0.0010	0.0010	A329931
Dissolved Boron (B)	mg/L	0.025	0.081	0.020	A331733			
Dissolved Calcium (Ca)	mg/L	170	430	0.30	A331733			
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0010	A329931	<0.0010	0.0010	A329931
Dissolved Cobalt (Co)	mg/L	0.00090	0.0021	0.00030	A329931	0.0020	0.00030	A329931
Dissolved Copper (Cu)	mg/L	0.00099	0.0046	0.00020	A329931	0.0043	0.00020	A329931
Dissolved Iron (Fe)	mg/L	0.14	0.087	0.060	A331733			
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	0.00020	A329931	<0.00020	0.00020	A329931
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	0.020	A331733			
Dissolved Magnesium (Mg)	mg/L	33	90	0.20	A331733			
Dissolved Manganese (Mn)	mg/L	0.65	1.5	0.0040	A331733			
Dissolved Molybdenum (Mo)	mg/L	0.00062	0.0014	0.00020	A329931	0.0012	0.00020	A329931
Dissolved Nickel (Ni)	mg/L	0.0028	0.0060	0.00050	A329931	0.0057	0.00050	A329931
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	0.10	A331733			
Dissolved Potassium (K)	mg/L	2.3	5.2	0.30	A331733			
Dissolved Selenium (Se)	mg/L	<0.00020	0.00031	0.00020	A329931	0.00023	0.00020	A329931
Dissolved Silicon (Si)	mg/L	4.7	4.0	0.10	A331733			
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010	A329931	<0.00010	0.00010	A329931
Dissolved Sodium (Na)	mg/L	13	9.9	0.50	A331733			
Dissolved Strontium (Sr)	mg/L	0.63	1.8	0.020	A331733			
Dissolved Sulphur (S)	mg/L	52	370	0.20	A331733			
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020	A329931	<0.00020	0.00020	A329931
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	0.0010	A329931	<0.0010	0.0010	A329931
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	0.0010	A329931	<0.0010	0.0010	A329931
Dissolved Uranium (U)	mg/L	0.00090	0.0016	0.00010	A329931	0.0015	0.00010	A329931
RDL = Reportable Detection Limit								
Lab-Dup = Laboratory Initiated Duplicate								



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BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AEH913	AEH914			AEH914		
Sampling Date		2021/08/20 13:20	2021/08/20 12:26			2021/08/20 12:26		
COC Number		299501	299501			299501		
	UNITS	CPF 98-8-3	CPF 97-7-5	RDL	QC Batch	CPF 97-7-5 Lab-Dup	RDL	QC Batch
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	0.0010	A329931	<0.0010	0.0010	A329931
Dissolved Zinc (Zn)	mg/L	0.0088	0.022 (1)	0.0030	A329931	0.024	0.0030	A329931
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate (1) Matrix Spike exceeds acceptance limits due to matrix interference. Reanalysis yields similar results.								



BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AEH915	AEH916		
Sampling Date		2021/08/20 15:42	2021/08/20 14:30		
COC Number		299501	299501		
	UNITS	C38 08-1-4	WSY 97-1-5	RDL	QC Batch
Elements					
Dissolved Aluminum (Al)	mg/L	0.17	0.019	0.0030	A329913
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	0.00060	A329913
Dissolved Arsenic (As)	mg/L	0.0047	0.00050	0.00020	A329913
Dissolved Barium (Ba)	mg/L	0.36	0.094	0.010	A331733
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010	A329913
Dissolved Boron (B)	mg/L	0.041	0.11	0.020	A331733
Dissolved Calcium (Ca)	mg/L	140	300	0.30	A331733
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0010	A329913
Dissolved Cobalt (Co)	mg/L	0.0025	<0.00030	0.00030	A329913
Dissolved Copper (Cu)	mg/L	0.00094	0.0014	0.00020	A329913
Dissolved Iron (Fe)	mg/L	14	0.074	0.060	A331733
Dissolved Lead (Pb)	mg/L	0.00021	<0.00020	0.00020	A329913
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	0.020	A331733
Dissolved Magnesium (Mg)	mg/L	50	52	0.20	A331733
Dissolved Manganese (Mn)	mg/L	0.55	0.051	0.0040	A331733
Dissolved Molybdenum (Mo)	mg/L	<0.00020	0.0057	0.00020	A329913
Dissolved Nickel (Ni)	mg/L	0.0043	0.0029	0.00050	A329913
Dissolved Phosphorus (P)	mg/L	0.48	<0.10	0.10	A331733
Dissolved Potassium (K)	mg/L	2.8	1.4	0.30	A331733
Dissolved Selenium (Se)	mg/L	0.00047	0.0074	0.00020	A329913
Dissolved Silicon (Si)	mg/L	8.8	4.9	0.10	A331733
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010	A329913
Dissolved Sodium (Na)	mg/L	25	12	0.50	A331733
Dissolved Strontium (Sr)	mg/L	0.40	0.82	0.020	A331733
Dissolved Sulphur (S)	mg/L	5.5	180	0.20	A331733
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020	A329913
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	0.0010	A329913
Dissolved Titanium (Ti)	mg/L	0.0045	<0.0010	0.0010	A329913
Dissolved Uranium (U)	mg/L	0.00053	0.0047	0.00010	A329913
Dissolved Vanadium (V)	mg/L	0.0012	<0.0010	0.0010	A329913
RDL = Reportable Detection Limit					



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BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AEH915	AEH916		
Sampling Date		2021/08/20 15:42	2021/08/20 14:30		
COC Number		299501	299501		
	UNITS	C38 08-1-4	WSY 97-1-5	RDL	QC Batch
Dissolved Zinc (Zn)	mg/L	0.0060	0.012	0.0030	A329913
RDL = Reportable Detection Limit					



BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AEH913
Sample ID: CPF 98-8-3
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A329964	N/A	2021/08/24	Kathleen Dalton
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/24	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A328990	N/A	2021/08/26	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A331998	N/A	2021/08/25	Nadia Rafique
Conductivity @25C	COND	A329970	N/A	2021/08/24	Kathleen Dalton
Fluoride	AT	A329971	N/A	2021/08/24	Kathleen Dalton
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329499	2021/08/24	2021/08/25	Grace (Quan) Guo
Hardness	CALC	A329079	N/A	2021/08/26	Automated Statchk
Mercury (Dissolved) by CV	CV	A336034	2021/08/30	2021/08/30	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A331733	N/A	2021/08/25	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A329931	N/A	2021/08/26	Anna Nelson
Ion Balance	CALC	A329060	N/A	2021/08/26	Automated Statchk
Nitrate and Nitrite	CALC	A328003	N/A	2021/08/25	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A328793	N/A	2021/08/23	Shanna McKort
Nitrate (as N)	CALC	A328004	2021/08/25	2021/08/25	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A330852	N/A	2021/08/25	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A332798	2021/08/26	2021/08/26	Haydee Estilong

BV Labs ID: AEH914
Sample ID: CPF 97-7-5
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A329964	N/A	2021/08/24	Kathleen Dalton
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/24	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A328990	N/A	2021/08/26	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A331998	N/A	2021/08/25	Nadia Rafique
Conductivity @25C	COND	A329970	N/A	2021/08/24	Kathleen Dalton
Fluoride	AT	A329971	N/A	2021/08/24	Kathleen Dalton
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329499	2021/08/24	2021/08/25	Grace (Quan) Guo
Hardness	CALC	A329079	N/A	2021/08/26	Automated Statchk
Mercury (Dissolved) by CV	CV	A336034	2021/08/30	2021/08/30	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A331733	N/A	2021/08/25	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A329931	N/A	2021/08/26	Anna Nelson
Ion Balance	CALC	A329060	N/A	2021/08/26	Automated Statchk
Nitrate and Nitrite	CALC	A328003	N/A	2021/08/25	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A329208	N/A	2021/08/23	Shanna McKort
Nitrate (as N)	CALC	A328004	2021/08/25	2021/08/25	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A330852	N/A	2021/08/25	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A332798	2021/08/26	2021/08/26	Haydee Estilong



BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AEH914 Dup
Sample ID: CPF 97-7-5
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Elements by ICPMS - Dissolved	ICPM	A329931	N/A	2021/08/26	Anna Nelson

BV Labs ID: AEH915
Sample ID: C38 08-1-4
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A329964	N/A	2021/08/24	Kathleen Dalton
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/24	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A328990	N/A	2021/08/27	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A331998	N/A	2021/08/25	Nadia Rafique
Conductivity @25C	COND	A329970	N/A	2021/08/24	Kathleen Dalton
Fluoride	AT	A329971	N/A	2021/08/24	Kathleen Dalton
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329499	2021/08/24	2021/08/26	Grace (Quan) Guo
Hardness	CALC	A329079	N/A	2021/08/26	Automated Statchk
Mercury (Dissolved) by CV	CV	A336034	2021/08/30	2021/08/30	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A331733	N/A	2021/08/25	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A329913	N/A	2021/08/26	Anna Nelson
Ion Balance	CALC	A329060	N/A	2021/08/26	Automated Statchk
Nitrate and Nitrite	CALC	A329080	N/A	2021/08/25	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A328793	N/A	2021/08/23	Shanna McKort
Nitrate (as N)	CALC	A328004	2021/08/25	2021/08/25	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A330852	N/A	2021/08/25	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A332798	2021/08/26	2021/08/26	Haydee Estilong

BV Labs ID: AEH916
Sample ID: WSY 97-1-5
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A329964	N/A	2021/08/24	Kathleen Dalton
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/24	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A328990	N/A	2021/08/27	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A331999	N/A	2021/08/25	Nadia Rafique
Conductivity @25C	COND	A329970	N/A	2021/08/24	Kathleen Dalton
Fluoride	AT	A329971	N/A	2021/08/24	Kathleen Dalton
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329499	2021/08/24	2021/08/26	Grace (Quan) Guo
Hardness	CALC	A329079	N/A	2021/08/26	Automated Statchk
Mercury (Dissolved) by CV	CV	A336034	2021/08/30	2021/08/30	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A331733	N/A	2021/08/25	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A329913	N/A	2021/08/26	Anna Nelson
Ion Balance	CALC	A329060	N/A	2021/08/26	Automated Statchk



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BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AEH916
Sample ID: WSY 97-1-5
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate and Nitrite	CALC	A329080	N/A	2021/08/25	Automated Statchk
NO2 (N); NO2 (N) + NO3 (N) in Water	AC/COL	A328793	N/A	2021/08/23	Shanna McKort
Nitrate (as N)	CALC	A328004	2021/08/25	2021/08/25	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A330852	N/A	2021/08/25	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A332798	2021/08/26	2021/08/26	Haydee Estilong

BV Labs ID: AEH917
Sample ID: SNP-21-DUP1
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/24	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329499	2021/08/24	2021/08/25	Grace (Quan) Guo

BV Labs ID: AEH917 Dup
Sample ID: SNP-21-DUP1
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329499	2021/08/24	2021/08/25	Grace (Quan) Guo



GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	2.3°C
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Results relate only to the items tested.

DATA QUALITY OVERVIEW

Lab ID	Client Sample ID	Matrix	Test Code	Analysis Type	Parameters	Deviation	Root Cause	Potential Impact
AEH914	CPF 97-7-5	Water	ICPMSABL-D	ELE	Zinc (Zn)	#1 Matrix Spike Recovery Below Control Limit	#1 Matrix Interference	This may represent a low bias for this parameter(s) in this sample.



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Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A328793	SKM	Method Blank	Dissolved Nitrite (N)	2021/08/23	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/08/23	<0.010		mg/L	
A329208	SKM	Method Blank	Dissolved Nitrite (N)	2021/08/23	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/08/23	<0.010		mg/L	
A329499	GG3	Method Blank	O-TERPHENYL (sur.)	2021/08/25		100	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/08/25	<0.10		mg/L	
A329773	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2021/08/24		98	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/08/24		103	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/08/24		94	%	50 - 140
			Benzene	2021/08/24	<0.00040		mg/L	
			Toluene	2021/08/24	<0.00040		mg/L	
			Ethylbenzene	2021/08/24	<0.00040		mg/L	
			m & p-Xylene	2021/08/24	<0.00080		mg/L	
			o-Xylene	2021/08/24	<0.00040		mg/L	
			F1 (C6-C10)	2021/08/24	<0.10		mg/L	
A329913	ANE	Method Blank	Dissolved Aluminum (Al)	2021/08/26	<0.0030		mg/L	
			Dissolved Chromium (Cr)	2021/08/26	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2021/08/26	<0.00030		mg/L	
			Dissolved Copper (Cu)	2021/08/26	<0.00020		mg/L	
			Dissolved Lead (Pb)	2021/08/26	<0.00020		mg/L	
			Dissolved Antimony (Sb)	2021/08/26	<0.00060		mg/L	
			Dissolved Molybdenum (Mo)	2021/08/26	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2021/08/26	<0.00050		mg/L	
			Dissolved Selenium (Se)	2021/08/26	<0.00020		mg/L	
			Dissolved Silver (Ag)	2021/08/26	<0.00010		mg/L	
			Dissolved Arsenic (As)	2021/08/26	<0.00020		mg/L	
			Dissolved Thallium (Tl)	2021/08/26	<0.00020		mg/L	
			Dissolved Tin (Sn)	2021/08/26	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2021/08/26	<0.0010		mg/L	
			Dissolved Uranium (U)	2021/08/26	<0.00010		mg/L	
			Dissolved Vanadium (V)	2021/08/26	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2021/08/26	<0.0030		mg/L	
			Dissolved Beryllium (Be)	2021/08/26	<0.0010		mg/L	
A329931	ANE	Method Blank	Dissolved Aluminum (Al)	2021/08/25	<0.0030		mg/L	
			Dissolved Chromium (Cr)	2021/08/25	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2021/08/25	<0.00030		mg/L	
			Dissolved Copper (Cu)	2021/08/25	<0.00020		mg/L	
			Dissolved Lead (Pb)	2021/08/25	<0.00020		mg/L	
			Dissolved Antimony (Sb)	2021/08/25	<0.00060		mg/L	
			Dissolved Molybdenum (Mo)	2021/08/25	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2021/08/25	<0.00050		mg/L	
			Dissolved Selenium (Se)	2021/08/25	<0.00020		mg/L	
			Dissolved Silver (Ag)	2021/08/25	<0.00010		mg/L	
			Dissolved Arsenic (As)	2021/08/25	<0.00020		mg/L	
			Dissolved Thallium (Tl)	2021/08/25	<0.00020		mg/L	
			Dissolved Tin (Sn)	2021/08/25	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2021/08/25	<0.0010		mg/L	
			Dissolved Uranium (U)	2021/08/25	<0.00010		mg/L	
			Dissolved Vanadium (V)	2021/08/25	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2021/08/25	<0.0030		mg/L	
			Dissolved Beryllium (Be)	2021/08/25	<0.0010		mg/L	
A329964	KD9	Method Blank	Alkalinity (Total as CaCO3)	2021/08/24	<1.0		mg/L	



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BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A329970	KD9	Method Blank	Alkalinity (PP as CaCO3)	2021/08/24	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/08/24	<1.0		mg/L	
			Carbonate (CO3)	2021/08/24	<1.0		mg/L	
			Hydroxide (OH)	2021/08/24	<1.0		mg/L	
			Conductivity	2021/08/24	<2.0		uS/cm	
A329971	KD9	Method Blank	Dissolved Fluoride (F)	2021/08/24	<0.050		mg/L	
A330852	TMU	Method Blank	Phenols	2021/08/25	<0.0015		mg/L	
A331733	MPU	Method Blank	Dissolved Iron (Fe)	2021/08/25	<0.060		mg/L	
			Dissolved Lithium (Li)	2021/08/25	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2021/08/25	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/08/25	<0.0040		mg/L	
			Dissolved Potassium (K)	2021/08/25	<0.30		mg/L	
			Dissolved Sodium (Na)	2021/08/25	<0.50		mg/L	
			Dissolved Strontium (Sr)	2021/08/25	<0.020		mg/L	
			Dissolved Sulphur (S)	2021/08/25	<0.20		mg/L	
			Dissolved Phosphorus (P)	2021/08/25	<0.10		mg/L	
			Dissolved Barium (Ba)	2021/08/25	<0.010		mg/L	
			Dissolved Silicon (Si)	2021/08/25	<0.10		mg/L	
			Dissolved Boron (B)	2021/08/25	<0.020		mg/L	
			Dissolved Calcium (Ca)	2021/08/25	<0.30		mg/L	
			Dissolved Chloride (Cl)	2021/08/25	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/08/25	<1.0		mg/L	
A331998	NR	Method Blank	Dissolved Chloride (Cl)	2021/08/25	<1.0		mg/L	
A331999	NR	Method Blank	Dissolved Sulphate (SO4)	2021/08/25	<1.0		mg/L	
			Dissolved Chloride (Cl)	2021/08/25	<1.0		mg/L	
A332798	HE1	Method Blank	Dissolved Sulphate (SO4)	2021/08/25	<1.0		mg/L	
A332798	HE1	Method Blank	Total Dissolved Solids	2021/08/26	<10		mg/L	
A336034	RK3	Method Blank	Dissolved Mercury (Hg)	2021/08/30	<0.0019		ug/L	
A329931	ANE	RPD [AEH914-03]	Dissolved Aluminum (Al)	2021/08/26	20		%	20
			Dissolved Chromium (Cr)	2021/08/26	NC		%	20
			Dissolved Cobalt (Co)	2021/08/26	3.4		%	20
			Dissolved Copper (Cu)	2021/08/26	5.0		%	20
			Dissolved Lead (Pb)	2021/08/26	NC		%	20
			Dissolved Antimony (Sb)	2021/08/26	13		%	20
			Dissolved Molybdenum (Mo)	2021/08/26	16		%	20
			Dissolved Nickel (Ni)	2021/08/26	6.5		%	20
			Dissolved Selenium (Se)	2021/08/26	NC		%	20
			Dissolved Silver (Ag)	2021/08/26	NC		%	20
			Dissolved Arsenic (As)	2021/08/26	NC		%	20
			Dissolved Thallium (Tl)	2021/08/26	NC		%	20
			Dissolved Tin (Sn)	2021/08/26	NC		%	20
			Dissolved Titanium (Ti)	2021/08/26	NC		%	20
			Dissolved Uranium (U)	2021/08/26	6.7		%	20
			Dissolved Vanadium (V)	2021/08/26	NC		%	20
			Dissolved Zinc (Zn)	2021/08/26	6.6		%	20
			Dissolved Beryllium (Be)	2021/08/26	NC		%	20
			F2 (C10-C16 Hydrocarbons)	2021/08/25	NC		%	30
A329499	GG3	RPD [AEH917-01]	Dissolved Aluminum (Al)	2021/08/26		88	%	80 - 120
A329931	ANE	Matrix Spike [AEH914-03]	Dissolved Chromium (Cr)	2021/08/26		96	%	80 - 120
			Dissolved Cobalt (Co)	2021/08/26		93	%	80 - 120
			Dissolved Copper (Cu)	2021/08/26		90	%	80 - 120
			Dissolved Lead (Pb)	2021/08/26		93	%	80 - 120
			Dissolved Antimony (Sb)	2021/08/26		91	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/08/26		107	%	80 - 120



BUREAU
VERITAS

BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Nickel (Ni)	2021/08/26		92	%	80 - 120
			Dissolved Selenium (Se)	2021/08/26		105	%	80 - 120
			Dissolved Silver (Ag)	2021/08/26		99	%	80 - 120
			Dissolved Arsenic (As)	2021/08/26		100	%	80 - 120
			Dissolved Thallium (Tl)	2021/08/26		94	%	80 - 120
			Dissolved Tin (Sn)	2021/08/26		100	%	80 - 120
			Dissolved Titanium (Ti)	2021/08/26		91	%	80 - 120
			Dissolved Uranium (U)	2021/08/26		93	%	80 - 120
			Dissolved Vanadium (V)	2021/08/26		100	%	80 - 120
			Dissolved Zinc (Zn)	2021/08/26		68 (1)	%	80 - 120
A336034	RK3	Matrix Spike [AEH916-04]	Dissolved Beryllium (Be)	2021/08/26		84	%	80 - 120
A328793	SKM	LCS	Dissolved Mercury (Hg)	2021/08/30		97	%	80 - 120
A329208	SKM	LCS	Dissolved Nitrite (N)	2021/08/23		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/08/23		102	%	80 - 120
			Dissolved Nitrite (N)	2021/08/23		103	%	80 - 120
A329499	GG3	LCS	Dissolved Nitrate plus Nitrite (N)	2021/08/23		103	%	80 - 120
			O-TERPHENYL (sur.)	2021/08/25		99	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/08/25		100	%	60 - 140
A329773	DO1	LCS	1,4-Difluorobenzene (sur.)	2021/08/24		94	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/08/24		102	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/08/24		93	%	50 - 140
			Benzene	2021/08/24		95	%	60 - 130
			Toluene	2021/08/24		97	%	60 - 130
			Ethylbenzene	2021/08/24		104	%	60 - 130
			m & p-Xylene	2021/08/24		101	%	60 - 130
			o-Xylene	2021/08/24		106	%	60 - 130
			F1 (C6-C10)	2021/08/24		109	%	60 - 140
			Dissolved Aluminum (Al)	2021/08/25		110	%	80 - 120
A329913	ANE	LCS	Dissolved Chromium (Cr)	2021/08/25		99	%	80 - 120
			Dissolved Cobalt (Co)	2021/08/25		100	%	80 - 120
			Dissolved Copper (Cu)	2021/08/25		103	%	80 - 120
			Dissolved Lead (Pb)	2021/08/25		94	%	80 - 120
			Dissolved Antimony (Sb)	2021/08/25		88	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/08/25		97	%	80 - 120
			Dissolved Nickel (Ni)	2021/08/25		99	%	80 - 120
			Dissolved Selenium (Se)	2021/08/25		110	%	80 - 120
			Dissolved Silver (Ag)	2021/08/25		95	%	80 - 120
			Dissolved Arsenic (As)	2021/08/25		100	%	80 - 120
A329931	ANE	LCS	Dissolved Thallium (Tl)	2021/08/25		94	%	80 - 120
			Dissolved Tin (Sn)	2021/08/25		92	%	80 - 120
			Dissolved Titanium (Ti)	2021/08/25		111	%	80 - 120
			Dissolved Uranium (U)	2021/08/25		92	%	80 - 120
			Dissolved Vanadium (V)	2021/08/25		101	%	80 - 120
			Dissolved Zinc (Zn)	2021/08/25		129 (1)	%	80 - 120
			Dissolved Beryllium (Be)	2021/08/25		99	%	80 - 120
			Dissolved Aluminum (Al)	2021/08/26		105	%	80 - 120
			Dissolved Chromium (Cr)	2021/08/26		99	%	80 - 120
			Dissolved Cobalt (Co)	2021/08/26		99	%	80 - 120
A329931	ANE	LCS	Dissolved Copper (Cu)	2021/08/26		99	%	80 - 120
			Dissolved Lead (Pb)	2021/08/26		98	%	80 - 120
			Dissolved Antimony (Sb)	2021/08/26		93	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/08/26		102	%	80 - 120



BUREAU
VERITAS

BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Nickel (Ni)	2021/08/26		98	%	80 - 120
			Dissolved Selenium (Se)	2021/08/26		106	%	80 - 120
			Dissolved Silver (Ag)	2021/08/26		99	%	80 - 120
			Dissolved Arsenic (As)	2021/08/26		101	%	80 - 120
			Dissolved Thallium (Tl)	2021/08/26		96	%	80 - 120
			Dissolved Tin (Sn)	2021/08/26		102	%	80 - 120
			Dissolved Titanium (Ti)	2021/08/26		102	%	80 - 120
			Dissolved Uranium (U)	2021/08/26		97	%	80 - 120
			Dissolved Vanadium (V)	2021/08/26		102	%	80 - 120
			Dissolved Zinc (Zn)	2021/08/26		103	%	80 - 120
			Dissolved Beryllium (Be)	2021/08/26		83	%	80 - 120
A329964	KD9	LCS	Alkalinity (Total as CaCO ₃)	2021/08/24		97	%	80 - 120
A329970	KD9	LCS	Conductivity	2021/08/24		99	%	90 - 110
A329971	KD9	LCS	Dissolved Fluoride (F)	2021/08/24		106	%	80 - 120
A330852	TMU	LCS	Phenols	2021/08/25		98	%	80 - 120
A331733	MPU	LCS	Dissolved Iron (Fe)	2021/08/25		112	%	80 - 120
			Dissolved Lithium (Li)	2021/08/25		104	%	80 - 120
			Dissolved Magnesium (Mg)	2021/08/25		102	%	80 - 120
			Dissolved Manganese (Mn)	2021/08/25		111	%	80 - 120
			Dissolved Potassium (K)	2021/08/25		101	%	80 - 120
			Dissolved Sodium (Na)	2021/08/25		101	%	80 - 120
			Dissolved Strontium (Sr)	2021/08/25		100	%	80 - 120
			Dissolved Sulphur (S)	2021/08/25		102	%	80 - 120
			Dissolved Phosphorus (P)	2021/08/25		101	%	80 - 120
			Dissolved Barium (Ba)	2021/08/25		104	%	80 - 120
			Dissolved Silicon (Si)	2021/08/25		100	%	80 - 120
			Dissolved Boron (B)	2021/08/25		104	%	80 - 120
			Dissolved Calcium (Ca)	2021/08/25		102	%	80 - 120
A331998	NR	LCS	Dissolved Chloride (Cl)	2021/08/25		100	%	80 - 120
			Dissolved Sulphate (SO ₄)	2021/08/25		100	%	80 - 120
A331999	NR	LCS	Dissolved Chloride (Cl)	2021/08/25		99	%	80 - 120
			Dissolved Sulphate (SO ₄)	2021/08/25		99	%	80 - 120
A332798	HE1	LCS	Total Dissolved Solids	2021/08/26		98	%	80 - 120
A336034	RK3	LCS	Dissolved Mercury (Hg)	2021/08/30		106	%	80 - 120

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

LCS: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference $\leq 2 \times$ RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU
VERITAS

BV Labs Job #: C161381
Report Date: 2021/08/30

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Gita Pokhrel, Laboratory Supervisor

Sandy Yuan, M.Sc., QP, Scientific Specialist

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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**EXXON MOBIL/IMPERIAL OIL - MAXXAM
CHAIN-OF-CUSTODY RECORD**

C of C # **299501**

INVOICE INFORMATION				REPORT INFORMATION				ANALYSIS REQUESTED																								
Company Name: ☒ Imperial Oil ☐ ExxonMobil				Company Name: <u>Worley</u>																												
Contact Name: <u>Alex Haigh</u>				Contact Name: <u>Alex Haigh</u>																												
Address: <u>150, 205 Quarry Park Blvd SE Calgary, AB T2C 3E7</u>				Address: <u>150, 205 Quarry Park Blvd SE Calgary, AB T2C 3E7</u>																												
Email: <u>alex.haigh@advisian.com</u>				Email: <u>alex.haigh@advisian.com</u>																												
Ph: <u>587-897-6249</u>				Ph: <u>587-897-6249</u>																												
Sampler Name (Print): <u>Stacy Gibb / Matt Eubank</u>				Consultant Project #: <u>417085-31872-21100</u>																												
FIELD SAMPLE ID	MATRIX				# CONTAINERS	SAMPLING		FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	VOC	PAH	PHCs (FRACTIONS 1-2 PLUS BTEX)	PHCs (FRACTIONS 1-4 PLUS BTEX)	PHCs (FRACTIONS 2-4)	PHCs (FRACTION 1 PLUS BTEX)	GRAIN SIZE (75 MICRON)	TEXTURE (% SAND, SILT, CLAY)	PARTICLE SIZE DISTRIBUTION WITH GRAPH	REGULATED METALS	TOTAL	DISSOLVED	SALINITY SOIL	FERTILIZER SOIL	FERTILIZER WATER	NUTRIENTS SOIL	ROUTINE POTABILITY	pH	EC	ALKALINITY	BASIC CLASS II LANDFILL PKG	Total Phosds	Fluoride
	GROUND WATER	SURFACE WATER	SOIL	OTHER		DATE (YYYY/MM/DD)	TIME (24 HR)																									
1 CPE 98-8-3	X				9	2021/08/20	13:20	X				X							X	X										X	X	
2 CPE 97-7-5	X				9	2021/08/20	12:26	X			X								X	X									X	X		
3 C38 08-1-4	X				9	2021/08/20	15:42	X			X								X	X									X	X		
4 WSY 97-1-5	X				9	2021/08/20	14:30	X			X								X	X									X	X		
5 SNP-21-DUP1	X				5	2021/08/20	10:26				X																					
6																																
7																																
8																																
9																																
10																																

IOL SITE LOCATION: <u>NORMAN, NEWELL, NT</u>				REGULATORY CRITERIA / DETECTION LIMITS:				SPECIAL INSTRUCTIONS: <u>email: Canada.chemistry@worleyparsons.ca</u> <u>cc: cal-10R data.tracking@</u>				# JARS USED & NOT SUBMITTED: <u>N/A</u>				TURNAROUND TIME: Standard (5 days) ☒ Rush (3 days) ☐ (2 days) ☐ (1 day) ☐ (same day) ☐			
IOL PROJECT # (if applicable): <u>N/A</u>				☐ Alberta Tier 1 ☐ CDWG															
MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: <u>417085-31872-21100</u>				☐ SEQG (SK) ☐ NoSC (SK)															
				☒ CCME (incl. level) <u>FAL</u>															

SEAL PRESENT		YES	NO	COOLER ID # <u>MCAL</u>			SEAL PRESENT		YES	NO	COOLER ID #			SEAL PRESENT		YES	NO	COOLER ID #		
SEAL INTACT		☒		TEMP °C <u>3</u> <u>2</u> <u>2</u>			SEAL INTACT		☒		TEMP °C			SEAL INTACT		☒		TEMP °C		
COOLING MEDIA PRESENT		☒		1 2 3			COOLING MEDIA PRESENT		☒		1 2 3			COOLING MEDIA PRESENT		☒		1 2 3		

RELINQUISHED BY:		DATE:	TIME (24 HR)	RECEIVED BY:		DATE:	TIME (24 HR)
1. <u>Stacy Gibb</u>		<u>2021/08/21</u>	<u>10:10</u>	1. <u>Reem Phillipos</u>		<u>2021/08/23</u>	<u>15:00</u>
2.				2.			
3.				3.			

COC-1010 (06/2016) IOL-AB		White: Maxxam		Yellow: Client	
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DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: <u>Advisian</u>	Sampling Date: <u>20-Aug-21</u>
Location: <u>Norman Wells</u>	Laboratory : <u>Bureau Veritas</u>
Consultant Project Number: <u>417085-31872.21100</u>	Sample Submission Number: <u>C161387</u>

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Instrument Surrogate Recovery	x			Laboratory control sample recovery of Dissolved Zinc (Zn) (129%) did not meet acceptance criteria (80-120%) for sample Spiked BlankA329913. All other laboratory QC met acceptance criteria.
Extraction Surrogate Recovery	x			
Method Blank Concentration	x			
Matrix Duplicate RPD	x			
Matrix Spike Recovery	x			
Lab Control Sample Recovery		x		

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Field Blank Concentration			x	All field QC samples met alert limits.
Trip Blank Concentration	x			
Equipment Blank Concentration			x	
Field Duplicate RPD	x			

Has CoA been signed off (Yes/No)?: Yes

Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: Yes

Were all samples analyzed within hold times (Yes/No)?: Yes

All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: n/a

Is Chain of Custody completed and signed (Yes/No)?: Yes

Were sample temperatures acceptable when they reached lab (Yes/No)?: Yes

Was a Data Quality Overview (DQO) issued (Yes/No)?: No

Date DQO was received: n/a

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale: _____

Data Reviewed by (Print): <u>Nandhini Durairaj</u>	Data Reviewed by (Signature): <u><i>D. Nandhini.</i></u>
Date: <u>16-Sep-21</u>	



Attention: Alex Haigh

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100
Your C.O.C. #: 299500

Report Date: 2021/08/31
Report #: R3065606
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C161387

Received: 2021/08/23, 15:00

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	4	AB SOP-00005	SM 23 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	6	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	6		Auto Calc
Cadmium - low level CCME - Dissolved	4		Auto Calc
Chloride/Sulphate by Auto Colourimetry	4	AB SOP-00020	SM23-4500-Cl/SO ₄ -E m
Conductivity @25C	4	AB SOP-00005	SM 23 2510 B m
Fluoride	4	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons in Water (F2; C10-C16) (1)	6	AB SOP-00037 AB SOP-00040	CCME PHC-CWS m
Hardness	4		Auto Calc
Mercury (Dissolved) by CV (2)	4	AB SOP-00084	BCMOE BCLM Oct2013 m
Elements by ICP - Dissolved (2)	4	AB SOP-00042	EPA 6010d R5 m
Elements by ICPMS - Dissolved (2)	4	AB SOP-00043	EPA 6020b R2 m
Ion Balance	4		Auto Calc
Nitrate and Nitrite	4		Auto Calc
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	4	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	4		Auto Calc
Phenols (4-AAP)	4	AB SOP-00088	EPA 9066 R0 m
Total Dissolved Solids (Filt. Residue)	4	AB SOP-00065	SM 23 2540 C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless



Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100
Your C.O.C. #: 299500

Attention: Alex Haigh

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Report Date: 2021/08/31
Report #: R3065606
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C161387

Received: 2021/08/23, 15:00

otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Silica gel clean up employed.

(2) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Mary (Xiaohong) Xu
Customer Solutions Representative
31 Aug 2021 14:54:34

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Namita Sahni, Customer Solutions Representative

Email: Namita.Sahni@bureauveritas.com

Phone# (604)639-2614

=====

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



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BV Labs Job #: C161387

Report Date: 2021/08/31

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

AT1 BTEX AND F1-F2 IN WATER (WATER)

BV Labs ID		AEI049	AEI050	AEI051	AEI052	AEI053	AEI074		
Sampling Date		2021/08/20 12:00	2021/08/20 16:02	2021/08/20 15:13	2021/08/20 13:40	2021/08/20 15:00	2021/08/20 16:00		
COC Number		299500	299500	299500	299500	299500	299500		
	UNITS	MTF 97-1-5	TF 03-12-3	MEBG-10-1-3	ARB-12-3-3	SNP-21-DUP2	SNP-21-DUP4	RDL	QC Batch
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A329504
Volatiles									
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A329773
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A329773
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A329773
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	A329773
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A329773
Xylenes (Total)	mg/L	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	0.00089	A329022
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A329022
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A329773
Extraction Surrogate Recovery (%)									
O-TERPHENYL (sur.)	%	97	99	94	95	94	97		A329504
Instrument Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	97	98	98	101	99	100		A329773
4-Bromofluorobenzene (sur.)	%	102	102	103	105	101	103		A329773
D4-1,2-Dichloroethane (sur.)	%	93	96	95	95	94	94		A329773
RDL = Reportable Detection Limit									

BV Labs ID		AEI074		
Sampling Date		2021/08/20 16:00		
COC Number		299500		
	UNITS	SNP-21-DUP4 Lab-Dup	RDL	QC Batch
Ext. Pet. Hydrocarbon				
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	0.10	A329504
Extraction Surrogate Recovery (%)				
O-TERPHENYL (sur.)	%	96		A329504
RDL = Reportable Detection Limit				
Lab-Dup = Laboratory Initiated Duplicate				



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BV Labs Job #: C161387

Report Date: 2021/08/31

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AEI049			AEI050			AEI051		
Sampling Date		2021/08/20 12:00			2021/08/20 16:02			2021/08/20 15:13		
COC Number		299500			299500			299500		
	UNITS	MTF 97-1-5	RDL	QC Batch	TF 03-12-3	RDL	QC Batch	MEBG-10-1-3	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO ₃)	mg/L	570	0.50	A328000	950	0.50	A328000	1300	0.50	A328000
Ion Balance (% Difference)	%	4.8	N/A	A329060	1.8	N/A	A329060	32	N/A	A328001
Dissolved Nitrate (N)	mg/L	3.1	0.050	A328004	<0.050	0.050	A328004	<0.050	0.050	A328004
Dissolved Nitrate (NO ₃)	mg/L	14	0.22	A328003	<0.22	0.22	A328003	<0.22	0.22	A328003
Dissolved Nitrite (NO ₂)	mg/L	<0.033	0.033	A328003	0.067	0.033	A328003	<0.033	0.033	A328003
Elements										
Dissolved Cadmium (Cd)	mg/L	0.00011	0.000020	A328990	0.000045	0.000020	A328990	0.000061	0.000020	A328990
Misc. Inorganics										
Conductivity	uS/cm	1100	2.0	A329970	1700	2.0	A329970	1100	2.0	A336785
Total Dissolved Solids	mg/L	820	10	A332798	990 (1)	25	A332798	750	10	A332798
Anions										
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A329964	<1.0	1.0	A329964	<1.0	1.0	A336777
Alkalinity (Total as CaCO ₃)	mg/L	200	1.0	A329964	720	1.0	A329964	280	1.0	A336777
Bicarbonate (HCO ₃)	mg/L	250	1.0	A329964	880	1.0	A329964	340	1.0	A336777
Carbonate (CO ₃)	mg/L	<1.0	1.0	A329964	<1.0	1.0	A329964	<1.0	1.0	A336777
Dissolved Fluoride (F)	mg/L	0.20	0.050	A329971	0.44	0.050	A329971	0.072	0.050	A329971
Hydroxide (OH)	mg/L	<1.0	1.0	A329964	<1.0	1.0	A329964	<1.0	1.0	A336777
Dissolved Chloride (Cl)	mg/L	1.3	1.0	A331998	84	1.0	A331998	<2.0 (2)	2.0	A335978
Dissolved Sulphate (SO ₄)	mg/L	400	5.0	A331998	180	1.0	A331998	370	5.0	A335978
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A328793	0.020	0.010	A329208	<0.010	0.010	A329208
Dissolved Nitrate plus Nitrite (N)	mg/L	3.1	0.050	A328793	<0.050 (2)	0.050	A329208	<0.050 (2)	0.050	A329208
Misc. Organics										
Phenols	mg/L	<0.0015	0.0015	A330852	<0.0015	0.0015	A330852	<0.0015	0.0015	A330852

RDL = Reportable Detection Limit

N/A = Not Applicable

(1) Detection limit raised based on sample volume used for analysis.

(2) Detection limits raised due to matrix interference.



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BV Labs Job #: C161387

Report Date: 2021/08/31

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AEI052		
Sampling Date		2021/08/20 13:40		
COC Number		299500		
	UNITS	ARB-12-3-3	RDL	QC Batch
Calculated Parameters				
Hardness (CaCO ₃)	mg/L	440	0.50	A328000
Ion Balance (% Difference)	%	1.4	N/A	A328001
Dissolved Nitrate (N)	mg/L	0.33	0.010	A328004
Dissolved Nitrate (NO ₃)	mg/L	1.5	0.044	A328003
Dissolved Nitrite (NO ₂)	mg/L	<0.033	0.033	A328003
Elements				
Dissolved Cadmium (Cd)	mg/L	0.000028	0.000020	A328990
Misc. Inorganics				
Conductivity	uS/cm	840	2.0	A329970
Total Dissolved Solids	mg/L	470	10	A332798
Anions				
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A329964
Alkalinity (Total as CaCO ₃)	mg/L	330	1.0	A329964
Bicarbonate (HCO ₃)	mg/L	400	1.0	A329964
Carbonate (CO ₃)	mg/L	<1.0	1.0	A329964
Dissolved Fluoride (F)	mg/L	0.11	0.050	A329971
Hydroxide (OH)	mg/L	<1.0	1.0	A329964
Dissolved Chloride (Cl)	mg/L	7.1	1.0	A331999
Dissolved Sulphate (SO ₄)	mg/L	140	1.0	A331999
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A328793
Dissolved Nitrate plus Nitrite (N)	mg/L	0.33	0.010	A328793
Misc. Organics				
Phenols	mg/L	0.0016	0.0015	A330852
RDL = Reportable Detection Limit				
N/A = Not Applicable				



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BV Labs Job #: C161387
Report Date: 2021/08/31

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

MERCURY BY COLD VAPOR (WATER)

BV Labs ID		AEI049	AEI050	AEI051	AEI052		
Sampling Date		2021/08/20 12:00	2021/08/20 16:02	2021/08/20 15:13	2021/08/20 13:40		
COC Number		299500	299500	299500	299500		
	UNITS	MTF 97-1-5	TF 03-12-3	MEBG-10-1-3	ARB-12-3-3	RDL	QC Batch
Elements							
Dissolved Mercury (Hg)	ug/L	<0.0019	<0.0019	<0.0019	0.0020	0.0019	A336034
RDL = Reportable Detection Limit							



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BV Labs Job #: C161387

Report Date: 2021/08/31

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AEI049	AEI050		AEI051		AEI052		
Sampling Date		2021/08/20 12:00	2021/08/20 16:02		2021/08/20 15:13		2021/08/20 13:40		
COC Number		299500	299500		299500		299500		
	UNITS	MTF 97-1-5	TF 03-12-3	QC Batch	MEBG-10-1-3	QC Batch	ARB-12-3-3	RDL	QC Batch
Elements									
Dissolved Aluminum (Al)	mg/L	0.0098	0.016	A329913	0.012	A329913	0.015	0.0030	A329913
Dissolved Antimony (Sb)	mg/L	0.00082	<0.00060	A329913	<0.00060	A329913	<0.00060	0.00060	A329913
Dissolved Arsenic (As)	mg/L	0.00028	0.0059	A329913	0.0011	A329913	0.0010	0.00020	A329913
Dissolved Barium (Ba)	mg/L	0.021	0.098	A331733	0.10	A335057	0.10	0.010	A331733
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	A329913	<0.0010	A329913	<0.0010	0.0010	A329913
Dissolved Boron (B)	mg/L	0.027	0.057	A331733	<0.020	A335057	0.030	0.020	A331733
Dissolved Calcium (Ca)	mg/L	170	240	A331733	380	A331733	120	0.30	A331733
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	A329913	<0.0010	A329913	<0.0010	0.0010	A329913
Dissolved Cobalt (Co)	mg/L	<0.00030	0.0047	A329913	0.0034	A329913	<0.00030	0.00030	A329913
Dissolved Copper (Cu)	mg/L	0.0052	0.0017	A329913	0.0011	A329913	0.0025	0.00020	A329913
Dissolved Iron (Fe)	mg/L	<0.060	15	A331733	1.8	A331733	0.086	0.060	A331733
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	A329913	<0.00020	A329913	<0.00020	0.00020	A329913
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	A331733	<0.020	A335057	<0.020	0.020	A331733
Dissolved Magnesium (Mg)	mg/L	38	86	A331733	75	A331733	36	0.20	A331733
Dissolved Manganese (Mn)	mg/L	<0.0040	0.68	A331733	2.2	A331733	0.048	0.0040	A331733
Dissolved Molybdenum (Mo)	mg/L	0.029	0.18	A329913	0.0043	A329913	0.0050	0.00020	A329913
Dissolved Nickel (Ni)	mg/L	0.0052	0.034	A329913	0.011	A329913	0.0030	0.00050	A329913
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	A331733	<0.10	A335057	0.26	0.10	A331733
Dissolved Potassium (K)	mg/L	1.0	5.1	A331733	1.5	A335057	1.8	0.30	A331733
Dissolved Selenium (Se)	mg/L	0.12	0.0019	A329913	0.00030	A329913	0.0058	0.00020	A329913
Dissolved Silicon (Si)	mg/L	5.1	12	A331733	4.8	A331733	5.4	0.10	A331733
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	A329913	<0.00010	A329913	<0.00010	0.00010	A329913
Dissolved Sodium (Na)	mg/L	3.1	41	A331733	14	A331733	12	0.50	A331733
Dissolved Strontium (Sr)	mg/L	0.32	0.91	A331733	0.90	A335057	0.40	0.020	A331733
Dissolved Sulphur (S)	mg/L	120	53	A331733	250	A331733	39	0.20	A331733
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	A329913	<0.00020	A329913	<0.00020	0.00020	A329913
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	A329913	<0.0010	A329913	<0.0010	0.0010	A329913
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0021	A329913	0.0013	A329913	<0.0010	0.0010	A329913
Dissolved Uranium (U)	mg/L	0.025	0.015	A329913	0.013	A329913	0.0048	0.00010	A329913
Dissolved Vanadium (V)	mg/L	<0.0010	0.0036	A329913	<0.0010	A329913	<0.0010	0.0010	A329913
Dissolved Zinc (Zn)	mg/L	0.0069	0.0075	A329913	<0.0030	A329913	0.0047	0.0030	A329913
RDL = Reportable Detection Limit									



BUREAU
VERITAS

BV Labs Job #: C161387
Report Date: 2021/08/31

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AEI049
Sample ID: MTF 97-1-5
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A329964	N/A	2021/08/24	Kathleen Dalton
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/24	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A328990	N/A	2021/08/27	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A331998	N/A	2021/08/25	Nadia Rafique
Conductivity @25C	COND	A329970	N/A	2021/08/24	Kathleen Dalton
Fluoride	AT	A329971	N/A	2021/08/24	Kathleen Dalton
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329504	2021/08/25	2021/08/26	Grace (Quan) Guo
Hardness	CALC	A328000	N/A	2021/08/26	Automated Statchk
Mercury (Dissolved) by CV	CV	A336034	2021/08/30	2021/08/30	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A331733	N/A	2021/08/25	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A329913	N/A	2021/08/26	Anna Nelson
Ion Balance	CALC	A329060	N/A	2021/08/26	Automated Statchk
Nitrate and Nitrite	CALC	A328003	N/A	2021/08/25	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A328793	N/A	2021/08/23	Shanna McKort
Nitrate (as N)	CALC	A328004	2021/08/25	2021/08/25	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A330852	N/A	2021/08/25	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A332798	2021/08/26	2021/08/26	Haydee Estilong

BV Labs ID: AEI050
Sample ID: TF 03-12-3
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A329964	N/A	2021/08/24	Kathleen Dalton
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/24	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A328990	N/A	2021/08/27	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A331998	N/A	2021/08/25	Nadia Rafique
Conductivity @25C	COND	A329970	N/A	2021/08/24	Kathleen Dalton
Fluoride	AT	A329971	N/A	2021/08/24	Kathleen Dalton
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329504	2021/08/25	2021/08/26	Grace (Quan) Guo
Hardness	CALC	A328000	N/A	2021/08/26	Automated Statchk
Mercury (Dissolved) by CV	CV	A336034	2021/08/30	2021/08/30	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A331733	N/A	2021/08/25	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A329913	N/A	2021/08/26	Anna Nelson
Ion Balance	CALC	A329060	N/A	2021/08/26	Automated Statchk
Nitrate and Nitrite	CALC	A328003	N/A	2021/08/25	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A329208	N/A	2021/08/23	Shanna McKort
Nitrate (as N)	CALC	A328004	2021/08/25	2021/08/25	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A330852	N/A	2021/08/25	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A332798	2021/08/26	2021/08/26	Haydee Estilong



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BV Labs Job #: C161387
Report Date: 2021/08/31

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AEI051
Sample ID: MEBG-10-1-3
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A336777	N/A	2021/08/31	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/24	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A328990	N/A	2021/08/27	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A335978	N/A	2021/08/30	Bradley Freake
Conductivity @25C	COND	A336785	N/A	2021/08/31	Ilonka Kovac
Fluoride	AT	A329971	N/A	2021/08/24	Kathleen Dalton
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329504	2021/08/25	2021/08/26	Grace (Quan) Guo
Hardness	CALC	A328000	N/A	2021/08/26	Automated Statchk
Mercury (Dissolved) by CV	CV	A336034	2021/08/30	2021/08/30	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A331733	N/A	2021/08/25	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A329913	N/A	2021/08/26	Anna Nelson
Ion Balance	CALC	A328001	N/A	2021/08/26	Automated Statchk
Nitrate and Nitrite	CALC	A328003	N/A	2021/08/25	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A329208	N/A	2021/08/23	Shanna McKort
Nitrate (as N)	CALC	A328004	2021/08/25	2021/08/25	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A330852	N/A	2021/08/25	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A332798	2021/08/26	2021/08/26	Haydee Estilong

BV Labs ID: AEI052
Sample ID: ARB-12-3-3
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A329964	N/A	2021/08/24	Kathleen Dalton
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/24	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A328990	N/A	2021/08/27	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A331999	N/A	2021/08/25	Nadia Rafique
Conductivity @25C	COND	A329970	N/A	2021/08/24	Kathleen Dalton
Fluoride	AT	A329971	N/A	2021/08/24	Kathleen Dalton
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329504	2021/08/25	2021/08/26	Grace (Quan) Guo
Hardness	CALC	A328000	N/A	2021/08/26	Automated Statchk
Mercury (Dissolved) by CV	CV	A336034	2021/08/30	2021/08/30	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A331733	N/A	2021/08/25	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A329913	N/A	2021/08/26	Anna Nelson
Ion Balance	CALC	A328001	N/A	2021/08/26	Automated Statchk
Nitrate and Nitrite	CALC	A328003	N/A	2021/08/25	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A328793	N/A	2021/08/23	Shanna McKort
Nitrate (as N)	CALC	A328004	2021/08/25	2021/08/25	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A330852	N/A	2021/08/25	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A332798	2021/08/26	2021/08/26	Haydee Estilong



BUREAU
VERITAS

BV Labs Job #: C161387
Report Date: 2021/08/31

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AEI053
Sample ID: SNP-21-DUP2
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/25	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329504	2021/08/25	2021/08/26	Grace (Quan) Guo

BV Labs ID: AEI074
Sample ID: SNP-21-DUP4
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A329773	N/A	2021/08/25	Darrus Ong
F1-BTEX	CALC/MS	A329022	N/A	2021/08/25	Automated Statchk
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329504	2021/08/25	2021/08/25	Grace (Quan) Guo

BV Labs ID: AEI074 Dup
Sample ID: SNP-21-DUP4
Matrix: Water

Collected: 2021/08/20
Relinquished: 2021/08/21
Received: 2021/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A329504	2021/08/25	2021/08/25	Grace (Quan) Guo



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VERITAS

BV Labs Job #: C161387
Report Date: 2021/08/31

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.7°C
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Sample AEI051 [MEBG-10-1-3] : Ionic imbalance; analysis performed in duplicate.

Sample AEI051, Elements by ICP - Dissolved: Test repeated.

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C161387
Report Date: 2021/08/31

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A328793	SKM	Method Blank	Dissolved Nitrite (N)	2021/08/23	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/08/23	<0.010		mg/L	
A329208	SKM	Method Blank	Dissolved Nitrite (N)	2021/08/23	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/08/23	<0.010		mg/L	
A329504	GG3	Method Blank	O-TERPHENYL (sur.)	2021/08/25		96	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/08/25	<0.10		mg/L	
A329773	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2021/08/24		98	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/08/24		103	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/08/24		94	%	50 - 140
			Benzene	2021/08/24	<0.00040		mg/L	
			Toluene	2021/08/24	<0.00040		mg/L	
			Ethylbenzene	2021/08/24	<0.00040		mg/L	
			m & p-Xylene	2021/08/24	<0.00080		mg/L	
			o-Xylene	2021/08/24	<0.00040		mg/L	
			F1 (C6-C10)	2021/08/24	<0.10		mg/L	
A329913	ANE	Method Blank	Dissolved Aluminum (Al)	2021/08/26	<0.0030		mg/L	
			Dissolved Chromium (Cr)	2021/08/26	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2021/08/26	<0.00030		mg/L	
			Dissolved Copper (Cu)	2021/08/26	<0.00020		mg/L	
			Dissolved Lead (Pb)	2021/08/26	<0.00020		mg/L	
			Dissolved Antimony (Sb)	2021/08/26	<0.00060		mg/L	
			Dissolved Molybdenum (Mo)	2021/08/26	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2021/08/26	<0.00050		mg/L	
			Dissolved Selenium (Se)	2021/08/26	<0.00020		mg/L	
			Dissolved Silver (Ag)	2021/08/26	<0.00010		mg/L	
			Dissolved Arsenic (As)	2021/08/26	<0.00020		mg/L	
			Dissolved Thallium (Tl)	2021/08/26	<0.00020		mg/L	
			Dissolved Tin (Sn)	2021/08/26	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2021/08/26	<0.0010		mg/L	
			Dissolved Uranium (U)	2021/08/26	<0.00010		mg/L	
			Dissolved Vanadium (V)	2021/08/26	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2021/08/26	<0.0030		mg/L	
			Dissolved Beryllium (Be)	2021/08/26	<0.0010		mg/L	
A329964	KD9	Method Blank	Alkalinity (Total as CaCO3)	2021/08/24	<1.0		mg/L	
			Alkalinity (PP as CaCO3)	2021/08/24	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/08/24	<1.0		mg/L	
			Carbonate (CO3)	2021/08/24	<1.0		mg/L	
			Hydroxide (OH)	2021/08/24	<1.0		mg/L	
A329970	KD9	Method Blank	Conductivity	2021/08/24	<2.0		uS/cm	
A329971	KD9	Method Blank	Dissolved Fluoride (F)	2021/08/24	<0.050		mg/L	
A330852	TMU	Method Blank	Phenols	2021/08/25	<0.0015		mg/L	
A331733	MPU	Method Blank	Dissolved Iron (Fe)	2021/08/25	<0.060		mg/L	
			Dissolved Lithium (Li)	2021/08/25	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2021/08/25	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/08/25	<0.0040		mg/L	
			Dissolved Potassium (K)	2021/08/25	<0.30		mg/L	
			Dissolved Sodium (Na)	2021/08/25	<0.50		mg/L	
			Dissolved Strontium (Sr)	2021/08/25	<0.020		mg/L	
			Dissolved Sulphur (S)	2021/08/25	<0.20		mg/L	
			Dissolved Phosphorus (P)	2021/08/25	<0.10		mg/L	
			Dissolved Barium (Ba)	2021/08/25	<0.010		mg/L	
			Dissolved Silicon (Si)	2021/08/25	<0.10		mg/L	



BUREAU
VERITAS

BV Labs Job #: C161387
Report Date: 2021/08/31

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A331998	NR	Method Blank	Dissolved Boron (B)	2021/08/25	<0.020		mg/L	
			Dissolved Calcium (Ca)	2021/08/25	<0.30		mg/L	
			Dissolved Chloride (Cl)	2021/08/25	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/08/25	<1.0		mg/L	
A331999	NR	Method Blank	Dissolved Chloride (Cl)	2021/08/25	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/08/25	<1.0		mg/L	
			Total Dissolved Solids	2021/08/26	<10		mg/L	
A332798	HE1	Method Blank	Dissolved Lithium (Li)	2021/08/28	<0.020		mg/L	
			Dissolved Potassium (K)	2021/08/28	<0.30		mg/L	
			Dissolved Strontium (Sr)	2021/08/28	<0.020		mg/L	
			Dissolved Phosphorus (P)	2021/08/28	<0.10		mg/L	
A335057	JAB	Method Blank	Dissolved Barium (Ba)	2021/08/28	<0.010		mg/L	
			Dissolved Boron (B)	2021/08/28	<0.020		mg/L	
			Dissolved Chloride (Cl)	2021/08/30	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/08/30	<1.0		mg/L	
A335978	BFE	Method Blank	Dissolved Mercury (Hg)	2021/08/30	<0.0019		ug/L	
A336034	RK3	Method Blank	Alkalinity (Total as CaCO3)	2021/08/31	<1.0		mg/L	
A336777	IKO	Method Blank	Alkalinity (PP as CaCO3)	2021/08/31	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/08/31	<1.0		mg/L	
			Carbonate (CO3)	2021/08/31	<1.0		mg/L	
			Hydroxide (OH)	2021/08/31	<1.0		mg/L	
A336785	IKO	Method Blank	Conductivity	2021/08/31	<2.0		uS/cm	
A329504	GG3	RPD [AEI074-01]	F2 (C10-C16 Hydrocarbons)	2021/08/25	NC		%	30
A329504	GG3	Matrix Spike [AEI049-05]	O-TERPHENYL (sur.)	2021/08/25		95	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/08/25		93	%	60 - 140
A328793	SKM	LCS	Dissolved Nitrite (N)	2021/08/23		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/08/23		102	%	80 - 120
A329208	SKM	LCS	Dissolved Nitrite (N)	2021/08/23		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/08/23		103	%	80 - 120
A329504	GG3	LCS	O-TERPHENYL (sur.)	2021/08/25		98	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/08/25		99	%	60 - 140
A329773	DO1	LCS	1,4-Difluorobenzene (sur.)	2021/08/24		94	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/08/24		102	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/08/24		93	%	50 - 140
			Benzene	2021/08/24		95	%	60 - 130
			Toluene	2021/08/24		97	%	60 - 130
			Ethylbenzene	2021/08/24		104	%	60 - 130
			m & p-Xylene	2021/08/24		101	%	60 - 130
			o-Xylene	2021/08/24		106	%	60 - 130
			F1 (C6-C10)	2021/08/24		109	%	60 - 140
			Dissolved Aluminum (Al)	2021/08/25		110	%	80 - 120
A329913	ANE	LCS	Dissolved Chromium (Cr)	2021/08/25		99	%	80 - 120
			Dissolved Cobalt (Co)	2021/08/25		100	%	80 - 120
			Dissolved Copper (Cu)	2021/08/25		103	%	80 - 120
			Dissolved Lead (Pb)	2021/08/25		94	%	80 - 120
			Dissolved Antimony (Sb)	2021/08/25		88	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/08/25		97	%	80 - 120
			Dissolved Nickel (Ni)	2021/08/25		99	%	80 - 120
			Dissolved Selenium (Se)	2021/08/25		110	%	80 - 120
			Dissolved Silver (Ag)	2021/08/25		95	%	80 - 120
			Dissolved Arsenic (As)	2021/08/25		100	%	80 - 120
			Dissolved Thallium (Tl)	2021/08/25		94	%	80 - 120



QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Tin (Sn)	2021/08/25		92	%	80 - 120
			Dissolved Titanium (Ti)	2021/08/25		111	%	80 - 120
			Dissolved Uranium (U)	2021/08/25		92	%	80 - 120
			Dissolved Vanadium (V)	2021/08/25		101	%	80 - 120
			Dissolved Zinc (Zn)	2021/08/25		129 (1)	%	80 - 120
			Dissolved Beryllium (Be)	2021/08/25		99	%	80 - 120
A329964	KD9	LCS	Alkalinity (Total as CaCO ₃)	2021/08/24		97	%	80 - 120
A329970	KD9	LCS	Conductivity	2021/08/24		99	%	90 - 110
A329971	KD9	LCS	Dissolved Fluoride (F)	2021/08/24		106	%	80 - 120
A330852	TMU	LCS	Phenols	2021/08/25		98	%	80 - 120
A331733	MPU	LCS	Dissolved Iron (Fe)	2021/08/25		112	%	80 - 120
			Dissolved Lithium (Li)	2021/08/25		104	%	80 - 120
			Dissolved Magnesium (Mg)	2021/08/25		102	%	80 - 120
			Dissolved Manganese (Mn)	2021/08/25		111	%	80 - 120
			Dissolved Potassium (K)	2021/08/25		101	%	80 - 120
			Dissolved Sodium (Na)	2021/08/25		101	%	80 - 120
			Dissolved Strontium (Sr)	2021/08/25		100	%	80 - 120
			Dissolved Sulphur (S)	2021/08/25		102	%	80 - 120
			Dissolved Phosphorus (P)	2021/08/25		101	%	80 - 120
			Dissolved Barium (Ba)	2021/08/25		104	%	80 - 120
			Dissolved Silicon (Si)	2021/08/25		100	%	80 - 120
			Dissolved Boron (B)	2021/08/25		104	%	80 - 120
			Dissolved Calcium (Ca)	2021/08/25		102	%	80 - 120
A331998	NR	LCS	Dissolved Chloride (Cl)	2021/08/25		100	%	80 - 120
			Dissolved Sulphate (SO ₄)	2021/08/25		100	%	80 - 120
A331999	NR	LCS	Dissolved Chloride (Cl)	2021/08/25		99	%	80 - 120
			Dissolved Sulphate (SO ₄)	2021/08/25		99	%	80 - 120
A332798	HE1	LCS	Total Dissolved Solids	2021/08/26		98	%	80 - 120
A335057	JAB	LCS	Dissolved Lithium (Li)	2021/08/28		94	%	80 - 120
			Dissolved Potassium (K)	2021/08/28		97	%	80 - 120
			Dissolved Strontium (Sr)	2021/08/28		94	%	80 - 120
			Dissolved Phosphorus (P)	2021/08/28		102	%	80 - 120
			Dissolved Barium (Ba)	2021/08/28		95	%	80 - 120
			Dissolved Boron (B)	2021/08/28		90	%	80 - 120
A335978	BFE	LCS	Dissolved Chloride (Cl)	2021/08/30		107	%	80 - 120
			Dissolved Sulphate (SO ₄)	2021/08/30		97	%	80 - 120
A336034	RK3	LCS	Dissolved Mercury (Hg)	2021/08/30		106	%	80 - 120
A336777	IKO	LCS	Alkalinity (Total as CaCO ₃)	2021/08/31		97	%	80 - 120
A336785	IKO	LCS	Conductivity	2021/08/31		102	%	90 - 110

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

LCS: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU
VERITAS

BV Labs Job #: C161387
Report Date: 2021/08/31

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Gita Pokhrel, Laboratory Supervisor

Sandy Yuan, M.Sc., QP, Scientific Specialist

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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**EXXON MOBIL/IMPERIAL OIL - MAXXAM
CHAIN-OF-CUSTODY RECORD**

Page 1 of 1

C of C # **299500**

INVOICE INFORMATION				REPORT INFORMATION				ANALYSIS REQUESTED																								
Company Name: ☒ Imperial Oil ☐ ExxonMobil				Company Name: <u>Worley</u>																												
Contact Name: <u>Alex Haigh</u>				Contact Name: <u>Alex Haigh</u>																												
Address: <u>150.205 Quarry Park Blvd SE</u> <u>Calgary, AB T2C 3E7</u>				Address: <u>150.205 Quarry Park Blvd SE</u> <u>Calgary, AB T2C 3E7</u>																												
Email: <u>alex.haigh@advisian.com</u>				Email: <u>alex.haigh@advisian.com</u>																												
Ph: <u>587 847 6249</u>				Ph: <u>587 847 6249</u>																												
Sampler Name (Print): <u>Stacy GIBB / Matt EUBANK</u>				Consultant Project #: <u>417085-31872-21100</u>																												
FIELD SAMPLE ID	MATRIX				# CONTAINERS	SAMPLING		FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	VOC	PAH	PHCs (FRACTIONS 1-2 PLUS BTEX)	PHCs (FRACTIONS 1-4 PLUS BTEX)	PHCs (FRACTIONS 2-4)	PHCs (FRACTION 1 PLUS BTEX)	GRAIN SIZE (75 MICRON)	TEXTURE (% SAND, SILT, CLAY)	PARTICLE SIZE DISTRIBUTION WITH GRAPH	REGULATED METALS	TOTAL	DISSOLVED	SALINITY SOIL	FERTILIZER SOIL	FERTILIZER WATER	NUTRIENTS SOIL	ROUTINE POTABILITY	pH	EC	ALKALINITY	BASIC CLASS II LANDFILL PKG	Total Phenols	Fluoride
	GROUND WATER	SURFACE WATER	SOIL	OTHER		DATE (YYYY/MM/DD)	TIME (24 HR)																									
1 MTF 97-1-5	X				9	2021/08/20	12:00	X				X							X	X										X	X	
2 TF 03-12-3	X				9		16:02	X				X							X	X										X	X	
3 MEBG-10-1-3	X				9		15:13	X				X							X	X										X	X	
4 ARB-12-3-3	X				9		13:40	X				X							X	X										X	X	
5 SNP-21-DUP2	X				5		15:00					X																				
6 SNP-21-DUP4	X				5		16:00					X																				
7																																
8																																
9																																
10																																

IOL SITE LOCATION <u>NORMAN WELLS, NT</u>				REGULATORY CRITERIA / DETECTION LIMITS:				SPECIAL INSTRUCTIONS <u>Canada, chemistry@worleyparsons.ca</u> <u>CACM, IOR data track</u>				# JARS USED & NOT SUBMITTED <u>N/A</u>				TURNAROUND TIME			
IOL PROJECT # (if applicable) <u>N/A</u>				☐ Alberta Tier 1 ☐ SEQG (SK) ☒ CCME (incl. level)				☐ CDWG ☐ NoSC (SK) ☐ Other								Standard (5 days) ☒ Rush (3 days) ☐ (2 days) ☐ (1 day) ☐ (same day) ☐			
MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM <u>417085-31872-21100</u>																			

SEAL PRESENT		YES	NO	COOLER ID # <u>MCAL</u>			SEAL PRESENT		YES	NO	COOLER ID #			SEAL PRESENT		YES	NO	COOLER ID #		
SEAL INTACT		☒		TEMP °C <u>0</u> <u>1</u> <u>1</u>			SEAL INTACT				TEMP °C			SEAL INTACT				TEMP °C		
COOLING MEDIA PRESENT		☒		1 2 3			COOLING MEDIA PRESENT				1 2 3			COOLING MEDIA PRESENT				1 2 3		

RELINQUISHED BY:		DATE:	TIME (24 HR)	RECEIVED BY:		DATE:	TIME (24 HR)
1. <u>Stacy Gibb</u>		2021/08/21	10:10	1. <u>Reem</u>		2021/08/23	15:00
2.				2.			
3.				3.			

LABORATORY		LABORATORY	
LABELED BY: <u>JMA</u>		VERIFIED BY: <u>RPS</u>	

DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 22-Aug-21, 21-Aug-21

Location: Norman Wells

Laboratory : Bureau Veritas

Consultant Project Number: 417085-31872.21100

Sample Submission Number: C161584

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Instrument Surrogate Recovery	x			All laboratory QC met acceptance criteria.
Extraction Surrogate Recovery	x			
Method Blank Concentration	x			
Matrix Duplicate RPD	x			
Matrix Spike Recovery	x			
Lab Control Sample Recovery	x			

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Field Blank Concentration			x	No field QC samples submitted.
Trip Blank Concentration			x	
Equipment Blank Concentration			x	
Field Duplicate RPD			x	

Has CoA been signed off (Yes/No)?:

Yes

Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?:

Yes

Were all samples analyzed within hold times (Yes/No)?:

No

All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?:

n/a

Is Chain of Custody completed and signed (Yes/No)?:

Yes

Were sample temperatures acceptable when they reached lab (Yes/No)?:

Yes

Was a Data Quality Overview (DQO) issued (Yes/No)?:

Yes

Date DQO was received:

31-Aug-21

Is data considered to be reliable (Yes/No)?:

Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Nandhini Durairaj

Date: 16-Sep-21

Data Reviewed by (Signature):

D. Nandhini.



Attention: Alex Haigh

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100
Your C.O.C. #: 299497

Report Date: 2021/08/31
Report #: R3065773
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C161584

Received: 2021/08/24, 08:00

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH (1)	4	AB SOP-00005	SM 23 2320 B m
BTEX/F1 in Water by HS GC/MS/FID (1)	4	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX (1)	4		Auto Calc
Cadmium - low level CCME - Dissolved (1)	4		Auto Calc
Chloride/Sulphate by Auto Colourimetry (1)	4	AB SOP-00020	SM23-4500-Cl/SO ₄ -E m
Conductivity @25C (1)	4	AB SOP-00005	SM 23 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16) (1, 2)	4	AB SOP-00037 AB SOP-00040	CCME PHC-CWS m
Hardness (1)	4		Auto Calc
Mercury (Dissolved) by CV (1, 3)	4	AB SOP-00084	BCMOE BCLM Oct2013 m
Elements by ICP - Dissolved (1, 3)	4	AB SOP-00042	EPA 6010d R5 m
Elements by ICPMS - Dissolved (1, 3)	4	AB SOP-00043	EPA 6020b R2 m
Ion Balance (1)	4		Auto Calc
Nitrate and Nitrite (1)	4		Auto Calc
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water (1)	4	AB SOP-00091	SM 23 4500 NO ₃ m
Nitrate (as N) (1)	4		Auto Calc
Phenols (4-AAP) (1)	4	AB SOP-00088	EPA 9066 R0 m
Total Dissolved Solids (Filt. Residue) (1)	4	AB SOP-00065	SM 23 2540 C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the



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Site Location: Norman Wells, NT
Project #: 417085-31872.21100
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Attention: Alex Haigh

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Report Date: 2021/08/31
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Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C161584

Received: 2021/08/24, 08:00

customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Bureau Veritas Calgary Environmental

(2) Silica gel clean up employed.

(3) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Mary (Xiaohong) Xu
Customer Solutions Representative
31 Aug 2021 16:47:41

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Namita Sahni, Customer Solutions Representative

Email: Namita.Sahni@bureauveritas.com

Phone# (604)639-2614

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BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



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BV Labs Job #: C161584
Report Date: 2021/08/31

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

AT1 BTEX AND F1-F2 IN WATER (WATER)

BV Labs ID		AEJ296			AEJ296			AEJ297		
Sampling Date		2021/08/22 09:19			2021/08/22 09:19			2021/08/21 11:24		
COC Number		299497			299497			299497		
	UNITS	BI-13-1-4	RDL	QC Batch	BI-13-1-4 Lab-Dup	RDL	QC Batch	GIQ8-10-2-4	RDL	QC Batch
Ext. Pet. Hydrocarbon										
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	0.10	A331972				14	0.10	A331972
Volatiles										
Benzene	mg/L	<0.00040	0.00040	A331681	<0.00040	0.00040	A331681	<0.00040	0.00040	A331681
Toluene	mg/L	<0.00040	0.00040	A331681	<0.00040	0.00040	A331681	<0.00040	0.00040	A331681
Ethylbenzene	mg/L	<0.00040	0.00040	A331681	<0.00040	0.00040	A331681	<0.00040	0.00040	A331681
m & p-Xylene	mg/L	<0.00080	0.00080	A331681	<0.00080	0.00080	A331681	0.0010	0.00080	A331681
o-Xylene	mg/L	<0.00040	0.00040	A331681	<0.00040	0.00040	A331681	0.00056	0.00040	A331681
Xylenes (Total)	mg/L	<0.00089	0.00089	A329965				0.0016	0.00089	A329965
F1 (C6-C10) - BTEX	mg/L	<0.10	0.10	A329965				0.44	0.10	A329965
F1 (C6-C10)	mg/L	<0.10	0.10	A331681	<0.10	0.10	A331681	0.44	0.10	A331681
Extraction										
Surrogate Recovery (%)										
O-TERPHENYL (sur.)	%	98		A331972				102		A331972
Instrument										
Surrogate Recovery (%)										
1,4-Difluorobenzene (sur.)	%	95		A331681	95		A331681	92		A331681
4-Bromofluorobenzene (sur.)	%	100		A331681	104		A331681	108		A331681
D4-1,2-Dichloroethane (sur.)	%	103		A331681	104		A331681	108		A331681
RDL = Reportable Detection Limit										
Lab-Dup = Laboratory Initiated Duplicate										



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Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

AT1 BTEX AND F1-F2 IN WATER (WATER)

BV Labs ID		AEJ298	AEJ299		
Sampling Date		2021/08/21 08:45	2021/08/21 08:56		
COC Number		299497	299497		
	UNITS	BIS-97-1-3	BI-13-3-4.5	RDL	QC Batch
Ext. Pet. Hydrocarbon					
F2 (C10-C16 Hydrocarbons)	mg/L	0.16	<0.10	0.10	A331972
Volatiles					
Benzene	mg/L	<0.00040	<0.00040	0.00040	A331681
Toluene	mg/L	<0.00040	<0.00040	0.00040	A331681
Ethylbenzene	mg/L	<0.00040	<0.00040	0.00040	A331681
m & p-Xylene	mg/L	<0.00080	<0.00080	0.00080	A331681
o-Xylene	mg/L	<0.00040	<0.00040	0.00040	A331681
Xylenes (Total)	mg/L	<0.00089	<0.00089	0.00089	A329965
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	0.10	A329965
F1 (C6-C10)	mg/L	<0.10	<0.10	0.10	A331681
Extraction					
Surrogate Recovery (%)					
O-TERPHENYL (sur.)	%	96	99		A331972
Instrument					
Surrogate Recovery (%)					
1,4-Difluorobenzene (sur.)	%	96	100		A331681
4-Bromofluorobenzene (sur.)	%	100	100		A331681
D4-1,2-Dichloroethane (sur.)	%	101	107		A331681
RDL = Reportable Detection Limit					



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BV Labs Job #: C161584

Report Date: 2021/08/31

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AEJ296			AEJ296			AEJ297		
Sampling Date		2021/08/22 09:19			2021/08/22 09:19			2021/08/21 11:24		
COC Number		299497			299497			299497		
	UNITS	BI-13-1-4	RDL	QC Batch	BI-13-1-4 Lab-Dup	RDL	QC Batch	GIQ8-10-2-4	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO ₃)	mg/L	420	0.50	A329375				1000	0.50	A329375
Ion Balance (% Difference)	%	3.2	N/A	A329382				2.7	N/A	A329382
Dissolved Nitrate (N)	mg/L	<0.10	0.10	A329398				<0.10	0.10	A329398
Dissolved Nitrate (NO ₃)	mg/L	<0.44	0.44	A329395				<0.44	0.44	A329395
Dissolved Nitrite (NO ₂)	mg/L	<0.033	0.033	A329395				<0.033	0.033	A329395
Elements										
Dissolved Cadmium (Cd)	mg/L	0.000025	0.000020	A329371				0.00046	0.000020	A329371
Misc. Inorganics										
Conductivity	uS/cm	860	2.0	A332711				1900	2.0	A332711
Total Dissolved Solids	mg/L	800	10	A333497				1500 (1)	25	A333496
Anions										
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A332709				<1.0	1.0	A332709
Alkalinity (Total as CaCO ₃)	mg/L	380	1.0	A332709				580	1.0	A332709
Bicarbonate (HCO ₃)	mg/L	470	1.0	A332709				710	1.0	A332709
Carbonate (CO ₃)	mg/L	<1.0	1.0	A332709				<1.0	1.0	A332709
Hydroxide (OH)	mg/L	<1.0	1.0	A332709				<1.0	1.0	A332709
Dissolved Chloride (Cl)	mg/L	5.3	1.0	A333223	5.5	1.0	A333223	21	1.0	A332769
Dissolved Sulphate (SO ₄)	mg/L	95	1.0	A333223	98	1.0	A333223	480	5.0	A332769
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A331055				<0.010	0.010	A331055
Dissolved Nitrate plus Nitrite (N)	mg/L	<0.10 (2)	0.10	A331055				<0.10 (2)	0.10	A331055
Misc. Organics										
Phenols	mg/L	0.0024	0.0015	A332477				0.030	0.0015	A332477

RDL = Reportable Detection Limit

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable

(1) Detection limit raised based on sample volume used for analysis.

(2) Detection limits raised due to matrix interference.

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Report Date: 2021/08/31

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Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AEJ298			AEJ299		
Sampling Date		2021/08/21 08:45			2021/08/21 08:56		
COC Number		299497			299497		
	UNITS	BIS-97-1-3	RDL	QC Batch	BI-13-3-4.5	RDL	QC Batch
Calculated Parameters							
Hardness (CaCO ₃)	mg/L	880	0.50	A329375	1100	0.50	A329375
Ion Balance (% Difference)	%	3.9	N/A	A329382	5.1	N/A	A329382
Dissolved Nitrate (N)	mg/L	0.39	0.010	A329398	<0.10	0.10	A329398
Dissolved Nitrate (NO ₃)	mg/L	1.7	0.044	A329395	<0.44	0.44	A329395
Dissolved Nitrite (NO ₂)	mg/L	<0.033	0.033	A329395	<0.033	0.033	A329395
Elements							
Dissolved Cadmium (Cd)	mg/L	0.000030	0.000020	A329371	0.00010	0.000020	A329371
Misc. Inorganics							
Conductivity	uS/cm	1600	2.0	A332711	2000	2.0	A332711
Total Dissolved Solids	mg/L	1000	10	A333496	1700	10	A333496
Anions							
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A332709	<1.0	1.0	A332709
Alkalinity (Total as CaCO ₃)	mg/L	770	1.0	A332709	390	1.0	A332709
Bicarbonate (HCO ₃)	mg/L	940	1.0	A332709	470	1.0	A332709
Carbonate (CO ₃)	mg/L	<1.0	1.0	A332709	<1.0	1.0	A332709
Hydroxide (OH)	mg/L	<1.0	1.0	A332709	<1.0	1.0	A332709
Dissolved Chloride (Cl)	mg/L	20	1.0	A332769	6.0	1.0	A332769
Dissolved Sulphate (SO ₄)	mg/L	180	1.0	A332769	860	5.0	A332769
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A331055	<0.010	0.010	A331055
Dissolved Nitrate plus Nitrite (N)	mg/L	0.39	0.010	A331055	<0.10 (1)	0.10	A331055
Misc. Organics							
Phenols	mg/L	<0.0015	0.0015	A332477	<0.0015	0.0015	A330951
RDL = Reportable Detection Limit N/A = Not Applicable (1) Detection limits raised due to matrix interference.							



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Site Location: Norman Wells, NT
Project #: 417085-31872.21100

MERCURY BY COLD VAPOR (WATER)

BV Labs ID		AEJ296	AEJ297	AEJ298	AEJ299		
Sampling Date		2021/08/22 09:19	2021/08/21 11:24	2021/08/21 08:45	2021/08/21 08:56		
COC Number		299497	299497	299497	299497		
	UNITS	BI-13-1-4	GIQ8-10-2-4	BIS-97-1-3	BI-13-3-4.5	RDL	QC Batch
Elements							
Dissolved Mercury (Hg)	ug/L	<0.0019	0.0067	<0.0019	<0.0019	0.0019	A336346
RDL = Reportable Detection Limit							



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Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AEJ296	AEJ297	AEJ298	AEJ299		
Sampling Date		2021/08/22 09:19	2021/08/21 11:24	2021/08/21 08:45	2021/08/21 08:56		
COC Number		299497	299497	299497	299497		
	UNITS	BI-13-1-4	GIQ8-10-2-4	BIS-97-1-3	BI-13-3-4.5	RDL	QC Batch
Elements							
Dissolved Aluminum (Al)	mg/L	0.0062	0.019	0.0052	0.029	0.0030	A333097
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	<0.00060	0.00060	A333097
Dissolved Arsenic (As)	mg/L	0.0029	0.0076	0.00067	0.0013	0.00020	A333097
Dissolved Barium (Ba)	mg/L	0.052	0.18	0.053	0.049	0.010	A333051
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A333097
Dissolved Boron (B)	mg/L	<0.020	0.032	<0.020	<0.020	0.020	A333051
Dissolved Calcium (Ca)	mg/L	110	310	220	270	0.30	A333051
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A333097
Dissolved Cobalt (Co)	mg/L	0.0020	0.015	0.0021	0.0032	0.00030	A333097
Dissolved Copper (Cu)	mg/L	0.0033	0.0082	0.0077	0.0046	0.00020	A333097
Dissolved Iron (Fe)	mg/L	9.7	3.8	0.11	0.85	0.060	A333051
Dissolved Lead (Pb)	mg/L	<0.00020	0.00040	<0.00020	0.00022	0.00020	A333097
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	<0.020	<0.020	0.020	A333051
Dissolved Magnesium (Mg)	mg/L	35	63	82	110	0.20	A333051
Dissolved Manganese (Mn)	mg/L	0.56	2.5	0.51	0.47	0.0040	A333051
Dissolved Molybdenum (Mo)	mg/L	0.0022	0.0011	0.0053	0.018	0.00020	A333097
Dissolved Nickel (Ni)	mg/L	0.0058	0.036	0.011	0.030	0.00050	A333097
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A333051
Dissolved Potassium (K)	mg/L	1.3	3.8	3.0	2.7	0.30	A333051
Dissolved Selenium (Se)	mg/L	0.00024	0.0029	0.00055	0.0012	0.00020	A333097
Dissolved Silicon (Si)	mg/L	2.7	5.5	4.4	4.7	0.10	A333051
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A333097
Dissolved Sodium (Na)	mg/L	11	58	16	11	0.50	A333051
Dissolved Strontium (Sr)	mg/L	0.73	1.4	0.82	0.83	0.020	A333051
Dissolved Sulphur (S)	mg/L	25	150	43	250	0.20	A333051
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	A333097
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A333097
Dissolved Titanium (Ti)	mg/L	0.0011	0.0014	<0.0010	<0.0010	0.0010	A333097
Dissolved Uranium (U)	mg/L	0.0016	0.011	0.0036	0.012	0.00010	A333097
Dissolved Vanadium (V)	mg/L	<0.0010	0.0011	<0.0010	<0.0010	0.0010	A333097
Dissolved Zinc (Zn)	mg/L	0.0097	0.097	0.0079	0.026	0.0030	A333097
RDL = Reportable Detection Limit							



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BV Labs Job #: C161584
Report Date: 2021/08/31

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AEJ296
Sample ID: BI-13-1-4
Matrix: Water

Collected: 2021/08/22
Relinquished: 2021/08/23
Received: 2021/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A332709	N/A	2021/08/26	Karen Graham
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A331681	N/A	2021/08/26	Darrus Ong
F1-BTEX	CALC/MS	A329965	N/A	2021/08/27	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A329371	N/A	2021/08/28	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A333223	N/A	2021/08/27	Bradley Freake
Conductivity @25C	COND	A332711	N/A	2021/08/26	Karen Graham
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A331972	2021/08/26	2021/08/27	Grace (Quan) Guo
Hardness	CALC	A329375	N/A	2021/08/28	Automated Statchk
Mercury (Dissolved) by CV	CV	A336346	2021/08/30	2021/08/30	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A333051	N/A	2021/08/28	Jason Bao
Elements by ICPMS - Dissolved	ICPM	A333097	N/A	2021/08/28	Kevin Huang
Ion Balance	CALC	A329382	N/A	2021/08/28	Automated Statchk
Nitrate and Nitrite	CALC	A329395	N/A	2021/08/27	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A331055	N/A	2021/08/25	Jacqueline Fahrner
Nitrate (as N)	CALC	A329398	2021/08/27	2021/08/27	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A332477	N/A	2021/08/26	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A333497	2021/08/27	2021/08/27	Amy Phan

BV Labs ID: AEJ296 Dup
Sample ID: BI-13-1-4
Matrix: Water

Collected: 2021/08/22
Relinquished: 2021/08/23
Received: 2021/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A331681	N/A	2021/08/26	Darrus Ong
Chloride/Sulphate by Auto Colourimetry	KONE	A333223	N/A	2021/08/27	Bradley Freake

BV Labs ID: AEJ297
Sample ID: GIQ8-10-2-4
Matrix: Water

Collected: 2021/08/21
Relinquished: 2021/08/23
Received: 2021/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A332709	N/A	2021/08/26	Karen Graham
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A331681	N/A	2021/08/26	Darrus Ong
F1-BTEX	CALC/MS	A329965	N/A	2021/08/27	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A329371	N/A	2021/08/28	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A332769	N/A	2021/08/26	Bradley Freake
Conductivity @25C	COND	A332711	N/A	2021/08/26	Karen Graham
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A331972	2021/08/26	2021/08/27	Grace (Quan) Guo
Hardness	CALC	A329375	N/A	2021/08/28	Automated Statchk
Mercury (Dissolved) by CV	CV	A336346	2021/08/30	2021/08/30	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A333051	N/A	2021/08/28	Jason Bao
Elements by ICPMS - Dissolved	ICPM	A333097	N/A	2021/08/28	Kevin Huang
Ion Balance	CALC	A329382	N/A	2021/08/28	Automated Statchk
Nitrate and Nitrite	CALC	A329395	N/A	2021/08/27	Automated Statchk



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BV Labs Job #: C161584
Report Date: 2021/08/31

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AEJ297
Sample ID: GIQ8-10-2-4
Matrix: Water

Collected: 2021/08/21
Relinquished: 2021/08/23
Received: 2021/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
NO2 (N); NO2 (N) + NO3 (N) in Water	AC/COL	A331055	N/A	2021/08/25	Jacqueline Fahrner
Nitrate (as N)	CALC	A329398	2021/08/27	2021/08/27	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A332477	N/A	2021/08/26	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A333496	2021/08/27	2021/08/27	Amy Phan

BV Labs ID: AEJ298
Sample ID: BIS-97-1-3
Matrix: Water

Collected: 2021/08/21
Relinquished: 2021/08/23
Received: 2021/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO3,HCO3,OH	AT/ALK	A332709	N/A	2021/08/26	Karen Graham
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A331681	N/A	2021/08/26	Darrus Ong
F1-BTEX	CALC/MS	A329965	N/A	2021/08/27	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A329371	N/A	2021/08/28	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A332769	N/A	2021/08/26	Bradley Freake
Conductivity @25C	COND	A332711	N/A	2021/08/26	Karen Graham
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A331972	2021/08/26	2021/08/27	Grace (Quan) Guo
Hardness	CALC	A329375	N/A	2021/08/28	Automated Statchk
Mercury (Dissolved) by CV	CV	A336346	2021/08/30	2021/08/31	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A333051	N/A	2021/08/26	Jason Bao
Elements by ICPMS - Dissolved	ICPM	A333097	N/A	2021/08/28	Kevin Huang
Ion Balance	CALC	A329382	N/A	2021/08/28	Automated Statchk
Nitrate and Nitrite	CALC	A329395	N/A	2021/08/27	Automated Statchk
NO2 (N); NO2 (N) + NO3 (N) in Water	AC/COL	A331055	N/A	2021/08/25	Jacqueline Fahrner
Nitrate (as N)	CALC	A329398	2021/08/27	2021/08/27	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A332477	N/A	2021/08/26	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A333496	2021/08/27	2021/08/27	Amy Phan

BV Labs ID: AEJ299
Sample ID: BI-13-3-4.5
Matrix: Water

Collected: 2021/08/21
Relinquished: 2021/08/23
Received: 2021/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO3,HCO3,OH	AT/ALK	A332709	N/A	2021/08/26	Karen Graham
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A331681	N/A	2021/08/26	Darrus Ong
F1-BTEX	CALC/MS	A329965	N/A	2021/08/27	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A329371	N/A	2021/08/28	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A332769	N/A	2021/08/26	Bradley Freake
Conductivity @25C	COND	A332711	N/A	2021/08/26	Karen Graham
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A331972	2021/08/26	2021/08/27	Grace (Quan) Guo
Hardness	CALC	A329375	N/A	2021/08/28	Automated Statchk
Mercury (Dissolved) by CV	CV	A336346	2021/08/30	2021/08/31	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A333051	N/A	2021/08/26	Jason Bao
Elements by ICPMS - Dissolved	ICPM	A333097	N/A	2021/08/28	Kevin Huang



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Site Location: Norman Wells, NT
Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AEJ299
Sample ID: BI-13-3-4.5
Matrix: Water

Collected: 2021/08/21
Relinquished: 2021/08/23
Received: 2021/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Ion Balance	CALC	A329382	N/A	2021/08/28	Automated Statchk
Nitrate and Nitrite	CALC	A329395	N/A	2021/08/27	Automated Statchk
NO2 (N); NO2 (N) + NO3 (N) in Water	AC/COL	A331055	N/A	2021/08/25	Jacqueline Fahrner
Nitrate (as N)	CALC	A329398	2021/08/27	2021/08/27	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A330951	N/A	2021/08/25	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A333496	2021/08/27	2021/08/27	Amy Phan

**GENERAL COMMENTS**

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.3°C
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Temperatures upon receipt at Bureau Veritas Labs [Calgary]

Package 1: [8.6] degrees C

Each temperature is the average of up to three cooler temperatures taken at receipt.

Sample AEJ297 [GIQ8-10-2-4] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Sample AEJ298 [BIS-97-1-3] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Sample AEJ299 [BI-13-3-4.5] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Results relate only to the items tested.

DATA QUALITY OVERVIEW

Lab ID	Client Sample ID	Matrix	Test Code	Analysis Type	Parameters	Deviation	Root Cause	Potential Impact
AEJ297	GIQ8-10-2-4	Water	NO ₂ +NO ₃ -C	CALC	Sample	#11 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.
AEJ298	BIS-97-1-3	Water	NO ₂ +NO ₃ -C	CALC	Sample	#11 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.
AEJ299	BI-13-3-4.5	Water	NO ₂ +NO ₃ -C	CALC	Sample	#11 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.



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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A330951	TMU	Method Blank	Phenols	2021/08/25	<0.0015		mg/L	
A331055	JFH	Method Blank	Dissolved Nitrite (N)	2021/08/25	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/08/25	<0.010		mg/L	
A331681	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2021/08/26		102	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/08/26		100	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/08/26		112	%	50 - 140
			Benzene	2021/08/26	<0.00040		mg/L	
			Toluene	2021/08/26	<0.00040		mg/L	
			Ethylbenzene	2021/08/26	<0.00040		mg/L	
			m & p-Xylene	2021/08/26	<0.00080		mg/L	
			o-Xylene	2021/08/26	<0.00040		mg/L	
			F1 (C6-C10)	2021/08/26	<0.10		mg/L	
A331972	GG3	Method Blank	O-TERPHENYL (sur.)	2021/08/27		100	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/08/27	<0.10		mg/L	
A332477	TMU	Method Blank	Phenols	2021/08/26	<0.0015		mg/L	
A332709	KGR	Method Blank	Alkalinity (Total as CaCO3)	2021/08/26	<1.0		mg/L	
			Alkalinity (PP as CaCO3)	2021/08/26	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/08/26	<1.0		mg/L	
			Carbonate (CO3)	2021/08/26	<1.0		mg/L	
			Hydroxide (OH)	2021/08/26	<1.0		mg/L	
A332711	KGR	Method Blank	Conductivity	2021/08/26	<2.0		uS/cm	
A332769	BFE	Method Blank	Dissolved Chloride (Cl)	2021/08/26	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/08/26	<1.0		mg/L	
A333051	JAB	Method Blank	Dissolved Iron (Fe)	2021/08/26	<0.060		mg/L	
			Dissolved Lithium (Li)	2021/08/26	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2021/08/26	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/08/26	<0.0040		mg/L	
			Dissolved Potassium (K)	2021/08/26	<0.30		mg/L	
			Dissolved Sodium (Na)	2021/08/26	<0.50		mg/L	
			Dissolved Strontium (Sr)	2021/08/26	<0.020		mg/L	
			Dissolved Sulphur (S)	2021/08/26	<0.20		mg/L	
			Dissolved Phosphorus (P)	2021/08/26	<0.10		mg/L	
			Dissolved Barium (Ba)	2021/08/26	<0.010		mg/L	
			Dissolved Silicon (Si)	2021/08/26	<0.10		mg/L	
			Dissolved Boron (B)	2021/08/26	<0.020		mg/L	
			Dissolved Calcium (Ca)	2021/08/26	<0.30		mg/L	
A333097	KH2	Method Blank	Dissolved Aluminum (Al)	2021/08/28	<0.0030		mg/L	
			Dissolved Chromium (Cr)	2021/08/28	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2021/08/28	<0.00030		mg/L	
			Dissolved Copper (Cu)	2021/08/28	<0.00020		mg/L	
			Dissolved Lead (Pb)	2021/08/28	<0.00020		mg/L	
			Dissolved Antimony (Sb)	2021/08/28	<0.00060		mg/L	
			Dissolved Molybdenum (Mo)	2021/08/28	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2021/08/28	<0.00050		mg/L	
			Dissolved Selenium (Se)	2021/08/28	<0.00020		mg/L	
			Dissolved Silver (Ag)	2021/08/28	<0.00010		mg/L	
			Dissolved Arsenic (As)	2021/08/28	<0.00020		mg/L	
			Dissolved Thallium (Tl)	2021/08/28	<0.00020		mg/L	
			Dissolved Tin (Sn)	2021/08/28	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2021/08/28	<0.0010		mg/L	
			Dissolved Uranium (U)	2021/08/28	<0.00010		mg/L	
			Dissolved Vanadium (V)	2021/08/28	<0.0010		mg/L	



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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A333223	BFE	Method Blank	Dissolved Zinc (Zn)	2021/08/28	<0.0030		mg/L	
			Dissolved Beryllium (Be)	2021/08/28	<0.0010		mg/L	
			Dissolved Chloride (Cl)	2021/08/27	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/08/27	<1.0		mg/L	
A333496	AP1	Method Blank	Total Dissolved Solids	2021/08/27	<10		mg/L	
A333497	AP1	Method Blank	Total Dissolved Solids	2021/08/27	<10		mg/L	
A336346	RK3	Method Blank	Dissolved Mercury (Hg)	2021/08/30	<0.0019		ug/L	
A331681	DO1	RPD [AEJ296-06]	Benzene	2021/08/26	NC		%	30
			Toluene	2021/08/26	NC		%	30
			Ethylbenzene	2021/08/26	NC		%	30
			m & p-Xylene	2021/08/26	NC		%	30
			o-Xylene	2021/08/26	NC		%	30
			F1 (C6-C10)	2021/08/26	NC		%	30
			Dissolved Chloride (Cl)	2021/08/27	2.7		%	20
			Dissolved Sulphate (SO4)	2021/08/27	2.3		%	20
A331681	DO1	Matrix Spike [AEJ297-06]	1,4-Difluorobenzene (sur.)	2021/08/26		97	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/08/26		109	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/08/26		112	%	50 - 140
			Benzene	2021/08/26		110	%	50 - 140
			Toluene	2021/08/26		102	%	50 - 140
			Ethylbenzene	2021/08/26		108	%	50 - 140
			m & p-Xylene	2021/08/26		103	%	50 - 140
			o-Xylene	2021/08/26		104	%	50 - 140
A331972	GG3	Matrix Spike [AEJ296-05]	F1 (C6-C10)	2021/08/26		86	%	60 - 140
			O-TERPHENYL (sur.)	2021/08/27		101	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/08/27		96	%	60 - 140
A333223	BFE	Matrix Spike [AEJ296-01]	Dissolved Chloride (Cl)	2021/08/27		103	%	80 - 120
			Dissolved Sulphate (SO4)	2021/08/27		NC	%	80 - 120
A336346	RK3	Matrix Spike [AEJ296-04]	Dissolved Mercury (Hg)	2021/08/30		95	%	80 - 120
A330951	TMU	LCS	Phenols	2021/08/25		98	%	80 - 120
A331055	JFH	LCS	Dissolved Nitrite (N)	2021/08/26		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/08/26		102	%	80 - 120
A331681	DO1	LCS	1,4-Difluorobenzene (sur.)	2021/08/26		97	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/08/26		104	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/08/26		114	%	50 - 140
			Benzene	2021/08/26		117	%	60 - 130
			Toluene	2021/08/26		108	%	60 - 130
			Ethylbenzene	2021/08/26		112	%	60 - 130
			m & p-Xylene	2021/08/26		108	%	60 - 130
			o-Xylene	2021/08/26		111	%	60 - 130
			F1 (C6-C10)	2021/08/26		108	%	60 - 140
			O-TERPHENYL (sur.)	2021/08/27		105	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/08/27		88	%	60 - 140
A332477	TMU	LCS	Phenols	2021/08/26		97	%	80 - 120
A332709	KGR	LCS	Alkalinity (Total as CaCO3)	2021/08/26		97	%	80 - 120
A332711	KGR	LCS	Conductivity	2021/08/26		100	%	90 - 110
A332769	BFE	LCS	Dissolved Chloride (Cl)	2021/08/26		103	%	80 - 120
			Dissolved Sulphate (SO4)	2021/08/26		99	%	80 - 120
A333051	JAB	LCS	Dissolved Iron (Fe)	2021/08/26		111	%	80 - 120
			Dissolved Lithium (Li)	2021/08/26		102	%	80 - 120
			Dissolved Magnesium (Mg)	2021/08/26		101	%	80 - 120
			Dissolved Manganese (Mn)	2021/08/26		109	%	80 - 120



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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A333097	KH2	LCS	Dissolved Potassium (K)	2021/08/26		103	%	80 - 120
			Dissolved Sodium (Na)	2021/08/26		100	%	80 - 120
			Dissolved Strontium (Sr)	2021/08/26		99	%	80 - 120
			Dissolved Sulphur (S)	2021/08/26		101	%	80 - 120
			Dissolved Phosphorus (P)	2021/08/26		101	%	80 - 120
			Dissolved Barium (Ba)	2021/08/26		100	%	80 - 120
			Dissolved Silicon (Si)	2021/08/26		101	%	80 - 120
			Dissolved Boron (B)	2021/08/26		103	%	80 - 120
			Dissolved Calcium (Ca)	2021/08/26		102	%	80 - 120
			Dissolved Aluminum (Al)	2021/08/26		100	%	80 - 120
			Dissolved Chromium (Cr)	2021/08/26		107	%	80 - 120
			Dissolved Cobalt (Co)	2021/08/26		109	%	80 - 120
			Dissolved Copper (Cu)	2021/08/26		110	%	80 - 120
			Dissolved Lead (Pb)	2021/08/26		104	%	80 - 120
			Dissolved Antimony (Sb)	2021/08/26		97	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/08/26		102	%	80 - 120
			Dissolved Nickel (Ni)	2021/08/26		107	%	80 - 120
			Dissolved Selenium (Se)	2021/08/26		110	%	80 - 120
			Dissolved Silver (Ag)	2021/08/26		101	%	80 - 120
			Dissolved Arsenic (As)	2021/08/26		103	%	80 - 120
			Dissolved Thallium (Tl)	2021/08/26		102	%	80 - 120
			Dissolved Tin (Sn)	2021/08/26		97	%	80 - 120
			Dissolved Titanium (Ti)	2021/08/26		97	%	80 - 120
			Dissolved Uranium (U)	2021/08/26		103	%	80 - 120
			Dissolved Vanadium (V)	2021/08/26		107	%	80 - 120
			Dissolved Zinc (Zn)	2021/08/26		114	%	80 - 120
A333223	BFE	LCS	Dissolved Beryllium (Be)	2021/08/26		93	%	80 - 120
			Dissolved Chloride (Cl)	2021/08/27		104	%	80 - 120
			Dissolved Sulphate (SO ₄)	2021/08/27		102	%	80 - 120
A333496	AP1	LCS	Total Dissolved Solids	2021/08/27		91	%	80 - 120
A333497	AP1	LCS	Total Dissolved Solids	2021/08/27		108	%	80 - 120
A336346	RK3	LCS	Dissolved Mercury (Hg)	2021/08/30		93	%	80 - 120

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

LCS: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).



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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Janet Gao, B.Sc., QP, Supervisor, Organics

Luba Shymushovska, B.Sc., QP, Senior Analyst, Organics

Sandy Yuan, M.Sc., QP, Scientific Specialist

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555
BKV

**EXXON MOBIL/IMPERIAL OIL - MAXXAM
CHAIN-OF-CUSTODY RECORD**

C of C # **299497**

INVOICE INFORMATION				REPORT INFORMATION				ANALYSIS REQUESTED																											
Company Name: ☒ Imperial Oil ☐ ExxonMobil				Company Name: <u>Worley</u>																															
Contact Name: <u>Alex Haigh</u>				Contact Name: <u>Alex Haigh</u>																															
Address: <u>150, 205 Quarry Park Blvd SE</u> <u>Calgary, AB T2C 3E7</u>				Address: <u>150, 205 Quarry Park Blvd SE</u> <u>Calgary, AB T2C 3E7</u>																															
Email: <u>alex.haigh@edv.com</u>				Email: <u>alex.haigh@edv.com</u>																															
Ph: <u>587-897-6249</u>				Ph: <u>587-897-6249</u>																															
Sampler Name (Print): <u>Stacy Gibb / Matt Eubank</u>				Consultant Project #: <u>417085-31872-21100</u>																															
FIELD SAMPLE ID	MATRIX				# CONTAINERS	SAMPLING			FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	VOC	PAH	PHCs (FRACTIONS 1-2 PLUS BTEX)	PHCs (FRACTIONS 1-4 PLUS BTEX)	PHCs (FRACTIONS 2-4)	PHCs (FRACTION 1 PLUS BTEX)	GRAIN SIZE (75 MICRON)	TEXTURE (% SAND, SILT, CLAY)	PARTICLE SIZE DISTRIBUTION WITH GRAPH	REGULATED METALS	TOTAL	DIS	DISSOLVED	SALINITY SOIL	FERTILIZER SOIL	FERTILIZER WATER	NUTRIENTS SOIL	ROUTINE POTABILITY	pH	EC	ALKALINITY	BASIC CLASS II LANDFILL PKG	Total phos		
	GROUND WATER	SURFACE WATER	SOIL	OTHER		DATE (YYYY/MM/DD)	TIME (24 HR)																												
1 <u>B1-13-1-4</u>	☒				9	<u>2021/08/22</u>	<u>9:19</u>	☒												☒	☒														
2 <u>GIR8-10-2-4</u>	☒				9	<u>2021/08/21</u>	<u>11:24</u>	☒												☒	☒														
3 <u>B15-97-1-3</u>	☒				9	<u>2021/08/21</u>	<u>8:45</u>	☒												☒	☒														
4 <u>B1-13-3-4.5</u>	☒				9	<u>2021/08/21</u>	<u>8:56</u>	☒												☒	☒														
5																																			
6																																			
7																																			
8																																			
9																																			
10																																			

IOL SITE LOCATION: <u>Norman Wells NT</u>				REGULATORY CRITERIA / DETECTION LIMITS:				SPECIAL INSTRUCTIONS: <u>email: canada.chem.sing@edv.com</u> <u>local: iordata@edv.com</u>				# JARS USED & NOT SUBMITTED: <u>NA</u>				TURNAROUND TIME:			
IOL PROJECT # (if applicable): <u>NA</u>				☐ Alberta Tier 1 ☐ SEQG (SK) ☒ CCME (incl. level)				☐ CDWG ☐ NoSC (SK) ☐ Other								Standard (5 days) ☒ Rush (3 days) ☐ (2 days) ☐ (1 day) ☐ (same day) ☐			
MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: <u>417085-31872-21100</u>																			

SEAL PRESENT		YES	NO	COOLER ID #			SEAL PRESENT		YES	NO	COOLER ID # <u>MCAL</u>			SEAL PRESENT		YES	NO	COOLER ID #		
SEAL INTACT		☒		TEMP °C <u>6</u> <u>4</u> <u>3</u>			SEAL INTACT		☒		TEMP °C <u>9</u> <u>9</u> <u>8</u>			SEAL INTACT				TEMP °C		
COOLING MEDIA PRESENT		☒					COOLING MEDIA PRESENT		☒					COOLING MEDIA PRESENT						

RELINQUISHED BY:		DATE:		TIME (24 HR)		RECEIVED BY:		DATE:		TIME (24 HR)	
1. <u>Stacy Gibb</u>		<u>2021/08/23</u>		<u>11:30</u>		1. <u>DE JI WV</u>		<u>2021/08/24</u>		<u>08:00</u>	
2. <u>DE JI WV</u>		<u>2021/08/24</u>		<u>13:00</u>		2. <u>Reem</u>		<u>2021/08/25</u>		<u>06:20</u>	
3.						3.					

DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 15-Sep-21

Location: Norman Wells

Laboratory : Bureau Veritas

Consultant Project Number: 417085-31872-21100

Sample Submission Number: C169894

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Instrument Surrogate Recovery	x			Laboratory control sample recovery of Dissolved Zinc (Zn) (122%) did not meet acceptance criteria (80-120%) for sample Spiked BlankA359137. All other laboratory QC met acceptance criteria.
Extraction Surrogate Recovery	x			
Method Blank Concentration	x			
Matrix Duplicate RPD			x	
Matrix Spike Recovery			x	
Lab Control Sample Recovery		x		

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Field Blank Concentration			x	Sample TF 03-12-1 and its field duplicate SNP-21-DUP1 exceeded the 80% alert limit for Dissolved Copper (Cu) (159%). All other QC samples met alert limits.
Trip Blank Concentration			x	
Equipment Blank Concentration			x	
Field Duplicate RPD		x		

Has CoA been signed off (Yes/No)?:

Yes

Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?:

Yes

Were all samples analyzed within hold times (Yes/No)?:

No

All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?:

n/a

Is Chain of Custody completed and signed (Yes/No)?:

Yes

Were sample temperatures acceptable when they reached lab (Yes/No)?:

Yes

Was a Data Quality Overview (DQO) issued (Yes/No)?:

Yes

Date DQO was received: 27-Sep-21

Is data considered to be reliable (Yes/No)?:

Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Scott Bowles

Date: 18-Mar-22

Data Reviewed by (Signature):

AB



Attention: Alex Haigh

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100
Your C.O.C. #: 299451

Report Date: 2021/09/27
Report #: R3076888
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C169894

Received: 2021/09/18, 14:50

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	5	AB SOP-00005	SM 23 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	6	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	6		Auto Calc
Cadmium - low level CCME - Dissolved	5		Auto Calc
Chloride/Sulphate by Auto Colourimetry	5	AB SOP-00020	SM23-4500-Cl/SO ₄ -E m
Conductivity @25C	5	AB SOP-00005	SM 23 2510 B m
Fluoride	5	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons in Water (F2; C10-C16) (1)	6	AB SOP-00037 AB SOP-00040	CCME PHC-CWS m
Hardness	5		Auto Calc
Mercury (Dissolved) by CV (2)	5	AB SOP-00084	BCMOE BCLM Oct2013 m
Elements by ICP - Dissolved (2)	5	AB SOP-00042	EPA 6010d R5 m
Elements by ICPMS - Dissolved (2)	5	AB SOP-00043	EPA 6020b R2 m
Ion Balance	5		Auto Calc
Nitrate and Nitrite	5		Auto Calc
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	5	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	5		Auto Calc
Phenols (4-AAP)	5	AB SOP-00088	EPA 9066 R0 m
Total Dissolved Solids (Filt. Residue)	5	AB SOP-00065	SM 23 2540 C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless



Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100
Your C.O.C. #: 299451

Attention: Alex Haigh

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Report Date: 2021/09/27
Report #: R3076888
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C169894

Received: 2021/09/18, 14:50

otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Silica gel clean up employed.

(2) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Namita Sahni
Customer Solutions Representative
27 Sep 2021 13:13:35

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Namita Sahni, Customer Solutions Representative

Email: Namita.Sahni@bureauveritas.com

Phone# (604)639-2614

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BUREAU
VERITAS

BV Labs Job #: C169894

Report Date: 2021/09/27

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872-21100

AT1 BTEX AND F1-F2 IN WATER (WATER)

BV Labs ID		AGG929	AGG930	AGG931	AGG932	AGG933	AGG934		
Sampling Date		2021/09/15 12:20	2021/09/15 10:35	2021/09/15 10:40	2021/09/15 11:55	2021/09/15 11:10	2021/09/15 11:30		
COC Number		299451	299451	299451	299451	299451	299451		
	UNITS	MTF 97-1-5	TF 03-12-3	SNP-21-DUP1	MEBG-10-1-3	ARB-12-3-3	WSY 97-1-5	RDL	QC Batch
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A358478
Volatiles									
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A358684
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A358684
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A358684
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	A358684
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A358684
Xylenes (Total)	mg/L	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	0.00089	A357868
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A357868
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A358684
Extraction									
Surrogate Recovery (%)									
O-TERPHENYL (sur.)	%	96	100	103	99	104	101		A358478
Instrument									
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	104	101	99	100	102	103		A358684
4-Bromofluorobenzene (sur.)	%	101	99	97	96	99	96		A358684
D4-1,2-Dichloroethane (sur.)	%	101	100	97	96	100	100		A358684
RDL = Reportable Detection Limit									



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BV Labs Job #: C169894

Report Date: 2021/09/27

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872-21100

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AGG929			AGG930	AGG931		
Sampling Date		2021/09/15 12:20			2021/09/15 10:35	2021/09/15 10:40		
COC Number		299451			299451	299451		
	UNITS	MTF 97-1-5	RDL	QC Batch	TF 03-12-3	SNP-21-DUP1	RDL	QC Batch
Calculated Parameters								
Hardness (CaCO ₃)	mg/L	960	0.50	A357881	950	1000	0.50	A357881
Ion Balance (% Difference)	%	0.44	N/A	A357882	3.7	2.6	N/A	A357882
Dissolved Nitrate (N)	mg/L	3.6	0.050	A357887	<0.010	<0.010	0.010	A357887
Dissolved Nitrate (NO ₃)	mg/L	16	0.22	A357886	<0.044	<0.044	0.044	A357886
Dissolved Nitrite (NO ₂)	mg/L	<0.033	0.033	A357886	<0.033	<0.033	0.033	A357886
Elements								
Dissolved Cadmium (Cd)	mg/L	0.00015	0.000020	A357878	0.000073	0.000054	0.000020	A357878
Misc. Inorganics								
Conductivity	uS/cm	1700	2.0	A358863	1600	1800	2.0	A358863
Total Dissolved Solids	mg/L	1300	10	A360985	1000 (1)	1200 (1)	25	A360985
Anions								
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A358861	<1.0	<1.0	1.0	A358861
Alkalinity (Total as CaCO ₃)	mg/L	290	1.0	A358861	650	750	1.0	A358861
Bicarbonate (HCO ₃)	mg/L	360	1.0	A358861	800	910	1.0	A358861
Carbonate (CO ₃)	mg/L	<1.0	1.0	A358861	<1.0	<1.0	1.0	A358861
Dissolved Fluoride (F)	mg/L	0.13	0.050	A358864	0.47	0.42	0.050	A358864
Hydroxide (OH)	mg/L	<1.0	1.0	A358861	<1.0	<1.0	1.0	A358861
Dissolved Chloride (Cl)	mg/L	1.4	1.0	A363859	72	76	1.0	A363859
Dissolved Sulphate (SO ₄)	mg/L	640	5.0	A363859	230	210	5.0	A363859
Nutrients								
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A359027	<0.010	<0.010	0.010	A359004
Dissolved Nitrate plus Nitrite (N)	mg/L	3.6	0.050	A359027	<0.010	<0.010	0.010	A359004
Misc. Organics								
Phenols	mg/L	<0.0015	0.0015	A359380	<0.0015	<0.0015	0.0015	A359379
RDL = Reportable Detection Limit								
N/A = Not Applicable								
(1) Detection limit raised based on sample volume used for analysis.								

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VERITASBV Labs Job #: C169894
Report Date: 2021/09/27

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872-21100

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AGG932			AGG933		
Sampling Date		2021/09/15 11:55			2021/09/15 11:10		
COC Number		299451			299451		
	UNITS	MEBG-10-1-3	RDL	QC Batch	ARB-12-3-3	RDL	QC Batch
Calculated Parameters							
Hardness (CaCO ₃)	mg/L	1500	0.50	A357881	510	0.50	A357881
Ion Balance (% Difference)	%	4.2	N/A	A357882	0.16	N/A	A357882
Dissolved Nitrate (N)	mg/L	<0.050	0.050	A357887	0.15	0.010	A357887
Dissolved Nitrate (NO ₃)	mg/L	<0.22	0.22	A357886	0.65	0.044	A357886
Dissolved Nitrite (NO ₂)	mg/L	<0.033	0.033	A357886	0.066	0.033	A357886
Elements							
Dissolved Cadmium (Cd)	mg/L	0.00023	0.000020	A357878	0.00012	0.000020	A357878
Misc. Inorganics							
Conductivity	uS/cm	2400	2.0	A358863	940	2.0	A358863
Total Dissolved Solids	mg/L	2000	10	A360985	580	10	A360985
Anions							
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A358861	6.0	1.0	A358861
Alkalinity (Total as CaCO ₃)	mg/L	490	1.0	A358861	410	1.0	A358861
Bicarbonate (HCO ₃)	mg/L	600	1.0	A358861	480	1.0	A358861
Carbonate (CO ₃)	mg/L	<1.0	1.0	A358861	7.2	1.0	A358861
Dissolved Fluoride (F)	mg/L	0.11	0.050	A358864	0.092	0.050	A358864
Hydroxide (OH)	mg/L	<1.0	1.0	A358861	<1.0	1.0	A358861
Dissolved Chloride (Cl)	mg/L	3.4	1.0	A363859	11	1.0	A363859
Dissolved Sulphate (SO ₄)	mg/L	1100	10	A363859	110	1.0	A363859
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A359021	0.020	0.010	A359027
Dissolved Nitrate plus Nitrite (N)	mg/L	<0.050 (1)	0.050	A359021	0.17	0.010	A359027
Misc. Organics							
Phenols	mg/L	<0.0015	0.0015	A359379	<0.0015	0.0015	A359379
RDL = Reportable Detection Limit N/A = Not Applicable (1) Detection limits raised due to matrix interference.							



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BV Labs Job #: C169894
Report Date: 2021/09/27

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872-21100

MERCURY BY COLD VAPOR (WATER)

BV Labs ID		AGG929	AGG930	AGG931	AGG932	AGG933		
Sampling Date		2021/09/15 12:20	2021/09/15 10:35	2021/09/15 10:40	2021/09/15 11:55	2021/09/15 11:10		
COC Number		299451	299451	299451	299451	299451		
	UNITS	MTF 97-1-5	TF 03-12-3	SNP-21-DUP1	MEBG-10-1-3	ARB-12-3-3	RDL	QC Batch
Elements								
Dissolved Mercury (Hg)	ug/L	<0.0019	0.0032	0.0033	0.0033	0.0048	0.0019	A363090
RDL = Reportable Detection Limit								



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BV Labs Job #: C169894
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGG929	AGG930	AGG931	AGG932	AGG933		
Sampling Date		2021/09/15 12:20	2021/09/15 10:35	2021/09/15 10:40	2021/09/15 11:55	2021/09/15 11:10		
COC Number		299451	299451	299451	299451	299451		
	UNITS	MTF 97-1-5	TF 03-12-3	SNP-21-DUP1	MEBG-10-1-3	ARB-12-3-3	RDL	QC Batch
Elements								
Dissolved Aluminum (Al)	mg/L	<0.0030	0.019	0.013	0.0047	0.021	0.0030	A359137
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	0.00060	<0.00060	<0.00060	0.00060	A359137
Dissolved Arsenic (As)	mg/L	0.00028	0.0063	0.0069	0.00047	0.0012	0.00020	A359137
Dissolved Barium (Ba)	mg/L	0.027	0.077	0.083	0.10	0.11	0.010	A359319
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A359137
Dissolved Boron (B)	mg/L	0.036	0.036	0.038	<0.020	0.039	0.020	A359319
Dissolved Calcium (Ca)	mg/L	270	240	250	440	130	0.30	A359319
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A359137
Dissolved Cobalt (Co)	mg/L	<0.00030	0.0044	0.0048	0.0045	0.00083	0.00030	A359137
Dissolved Copper (Cu)	mg/L	0.0035	0.00032	0.0028	0.0047	0.0044	0.00020	A359137
Dissolved Iron (Fe)	mg/L	0.067	11	13	0.39	0.20	0.060	A359319
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	A359137
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A359319
Dissolved Magnesium (Mg)	mg/L	68	86	91	89	42	0.20	A359319
Dissolved Manganese (Mn)	mg/L	<0.0040	0.51	0.57	2.5	0.52	0.0040	A359319
Dissolved Molybdenum (Mo)	mg/L	0.017	0.19	0.21	0.0043	0.0043	0.00020	A359137
Dissolved Nickel (Ni)	mg/L	0.0049	0.031	0.036	0.013	0.0049	0.00050	A359137
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	<0.10	0.24	0.10	A359319
Dissolved Potassium (K)	mg/L	1.6	5.2	5.5	1.6	2.5	0.30	A359319
Dissolved Selenium (Se)	mg/L	0.19	0.0014	0.0014	0.00036	0.00071	0.00020	A359137
Dissolved Silicon (Si)	mg/L	3.9	11	12	4.8	4.5	0.10	A359319
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A359137
Dissolved Sodium (Na)	mg/L	3.3	46	43	14	14	0.50	A359319
Dissolved Strontium (Sr)	mg/L	0.53	0.89	0.95	1.1	0.49	0.020	A359319
Dissolved Sulphur (S)	mg/L	190	63	58	300	30	0.20	A359319
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	A359137
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A359137
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0020	0.0019	<0.0010	<0.0010	0.0010	A359137
Dissolved Uranium (U)	mg/L	0.029	0.015	0.014	0.017	0.0069	0.00010	A359137
Dissolved Vanadium (V)	mg/L	<0.0010	0.0035	0.0039	<0.0010	<0.0010	0.0010	A359137
Dissolved Zinc (Zn)	mg/L	0.0080	0.0042	0.0084	0.0096	0.011	0.0030	A359137
RDL = Reportable Detection Limit								



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BV Labs Job #: C169894
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

TEST SUMMARY

BV Labs ID: AGG929
Sample ID: MTF 97-1-5
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A358861	N/A	2021/09/21	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A358684	N/A	2021/09/23	Darrus Ong
F1-BTEX	CALC/MS	A357868	N/A	2021/09/24	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A357878	N/A	2021/09/21	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A363859	N/A	2021/09/23	Nadia Rafique
Conductivity @25C	COND	A358863	N/A	2021/09/21	Ilonka Kovac
Fluoride	AT	A358864	N/A	2021/09/21	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini
Hardness	CALC	A357881	N/A	2021/09/24	Automated Statchk
Mercury (Dissolved) by CV	CV	A363090	2021/09/23	2021/09/23	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A359319	N/A	2021/09/23	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A359137	N/A	2021/09/21	Lesley Quan
Ion Balance	CALC	A357882	N/A	2021/09/24	Automated Statchk
Nitrate and Nitrite	CALC	A357886	N/A	2021/09/21	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A359027	N/A	2021/09/20	Jacqueline Fahrner
Nitrate (as N)	CALC	A357887	2021/09/21	2021/09/21	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A359380	N/A	2021/09/21	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A360985	2021/09/22	2021/09/23	Lisa Thum

BV Labs ID: AGG930
Sample ID: TF 03-12-3
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A358861	N/A	2021/09/21	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A358684	N/A	2021/09/23	Darrus Ong
F1-BTEX	CALC/MS	A357868	N/A	2021/09/24	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A357878	N/A	2021/09/21	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A363859	N/A	2021/09/23	Nadia Rafique
Conductivity @25C	COND	A358863	N/A	2021/09/21	Ilonka Kovac
Fluoride	AT	A358864	N/A	2021/09/21	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini
Hardness	CALC	A357881	N/A	2021/09/24	Automated Statchk
Mercury (Dissolved) by CV	CV	A363090	2021/09/23	2021/09/23	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A359319	N/A	2021/09/23	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A359137	N/A	2021/09/21	Lesley Quan
Ion Balance	CALC	A357882	N/A	2021/09/24	Automated Statchk
Nitrate and Nitrite	CALC	A357886	N/A	2021/09/21	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A359004	N/A	2021/09/20	Jacqueline Fahrner
Nitrate (as N)	CALC	A357887	2021/09/21	2021/09/21	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A359379	N/A	2021/09/21	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A360985	2021/09/22	2021/09/23	Lisa Thum



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BV Labs Job #: C169894
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

TEST SUMMARY

BV Labs ID: AGG931
Sample ID: SNP-21-DUP1
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A358861	N/A	2021/09/21	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A358684	N/A	2021/09/23	Darrus Ong
F1-BTEX	CALC/MS	A357868	N/A	2021/09/24	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A357878	N/A	2021/09/21	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A363859	N/A	2021/09/23	Nadia Rafique
Conductivity @25C	COND	A358863	N/A	2021/09/21	Ilonka Kovac
Fluoride	AT	A358864	N/A	2021/09/21	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini
Hardness	CALC	A357881	N/A	2021/09/24	Automated Statchk
Mercury (Dissolved) by CV	CV	A363090	2021/09/23	2021/09/23	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A359319	N/A	2021/09/23	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A359137	N/A	2021/09/21	Lesley Quan
Ion Balance	CALC	A357882	N/A	2021/09/24	Automated Statchk
Nitrate and Nitrite	CALC	A357886	N/A	2021/09/21	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A359004	N/A	2021/09/20	Jacqueline Fahrner
Nitrate (as N)	CALC	A357887	2021/09/21	2021/09/21	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A359379	N/A	2021/09/21	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A360985	2021/09/22	2021/09/23	Lisa Thum

BV Labs ID: AGG932
Sample ID: MEBG-10-1-3
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A358861	N/A	2021/09/21	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A358684	N/A	2021/09/23	Darrus Ong
F1-BTEX	CALC/MS	A357868	N/A	2021/09/24	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A357878	N/A	2021/09/21	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A363859	N/A	2021/09/23	Nadia Rafique
Conductivity @25C	COND	A358863	N/A	2021/09/21	Ilonka Kovac
Fluoride	AT	A358864	N/A	2021/09/21	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini
Hardness	CALC	A357881	N/A	2021/09/24	Automated Statchk
Mercury (Dissolved) by CV	CV	A363090	2021/09/23	2021/09/23	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A359319	N/A	2021/09/23	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A359137	N/A	2021/09/21	Lesley Quan
Ion Balance	CALC	A357882	N/A	2021/09/24	Automated Statchk
Nitrate and Nitrite	CALC	A357886	N/A	2021/09/21	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A359021	N/A	2021/09/21	Jacqueline Fahrner
Nitrate (as N)	CALC	A357887	2021/09/21	2021/09/21	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A359379	N/A	2021/09/21	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A360985	2021/09/22	2021/09/23	Lisa Thum



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BV Labs Job #: C169894

Report Date: 2021/09/27

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872-21100

TEST SUMMARY

BV Labs ID: AGG933
Sample ID: ARB-12-3-3
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A358861	N/A	2021/09/21	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A358684	N/A	2021/09/23	Darrus Ong
F1-BTEX	CALC/MS	A357868	N/A	2021/09/24	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A357878	N/A	2021/09/21	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A363859	N/A	2021/09/23	Nadia Rafique
Conductivity @25C	COND	A358863	N/A	2021/09/21	Ilonka Kovac
Fluoride	AT	A358864	N/A	2021/09/21	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini
Hardness	CALC	A357881	N/A	2021/09/24	Automated Statchk
Mercury (Dissolved) by CV	CV	A363090	2021/09/23	2021/09/23	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A359319	N/A	2021/09/23	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A359137	N/A	2021/09/21	Lesley Quan
Ion Balance	CALC	A357882	N/A	2021/09/24	Automated Statchk
Nitrate and Nitrite	CALC	A357886	N/A	2021/09/21	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A359027	N/A	2021/09/20	Jacqueline Fahrner
Nitrate (as N)	CALC	A357887	2021/09/21	2021/09/21	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A359379	N/A	2021/09/21	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A360985	2021/09/22	2021/09/23	Lisa Thum

BV Labs ID: AGG934
Sample ID: WSY 97-1-5
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A358684	N/A	2021/09/23	Darrus Ong
F1-BTEX	CALC/MS	A357868	N/A	2021/09/24	Automated Statchk
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini

**GENERAL COMMENTS**

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.3°C
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Sample AGG929 [MTF 97-1-5] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Sample AGG930 [TF 03-12-3] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Sample AGG931 [SNP-21-DUP1] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Sample AGG932 [MEBG-10-1-3] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Sample AGG933 [ARB-12-3-3] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Results relate only to the items tested.

DATA QUALITY OVERVIEW

Lab ID	Client Sample ID	Matrix	Test Code	Analysis Type	Parameters	Deviation	Root Cause	Potential Impact
AGG929	MTF 97-1-5	Water	NO23AC-W	NUTS	Sample	#10 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.
AGG930	TF 03-12-3	Water	NO23AC-W	NUTS	Sample	#10 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.
AGG931	SNP-21-DUP1	Water	NO23AC-W	NUTS	Sample	#10 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.
AGG932	MEBG-10-1-3	Water	NO23AC-W	NUTS	Sample	#10 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.
AGG933	ARB-12-3-3	Water	NO2+NO3-C	CALC	Sample	#10 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.

BUREAU
VERITASBV Labs Job #: C169894
Report Date: 2021/09/27Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A358478	SEH	Method Blank	O-TERPHENYL (sur.)	2021/09/24		102	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/24	<0.10		mg/L	
A358684	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2021/09/23		100	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/23		96	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/23		97	%	50 - 140
			Benzene	2021/09/23	<0.00040		mg/L	
			Toluene	2021/09/23	<0.00040		mg/L	
			Ethylbenzene	2021/09/23	<0.00040		mg/L	
			m & p-Xylene	2021/09/23	<0.00080		mg/L	
			o-Xylene	2021/09/23	<0.00040		mg/L	
			F1 (C6-C10)	2021/09/23	<0.10		mg/L	
A358861	IKO	Method Blank	Alkalinity (Total as CaCO ₃)	2021/09/21	<1.0		mg/L	
			Alkalinity (PP as CaCO ₃)	2021/09/21	<1.0		mg/L	
			Bicarbonate (HCO ₃)	2021/09/21	<1.0		mg/L	
			Carbonate (CO ₃)	2021/09/21	<1.0		mg/L	
			Hydroxide (OH)	2021/09/21	<1.0		mg/L	
A358863	IKO	Method Blank	Conductivity	2021/09/20	<2.0		uS/cm	
A358864	IKO	Method Blank	Dissolved Fluoride (F)	2021/09/20	<0.050		mg/L	
A359004	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/20	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/20	<0.010		mg/L	
A359021	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/21	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/21	<0.010		mg/L	
A359027	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/20	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/20	<0.010		mg/L	
A359137	LQ1	Method Blank	Dissolved Aluminum (Al)	2021/09/21	<0.0030		mg/L	
			Dissolved Chromium (Cr)	2021/09/21	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2021/09/21	<0.00030		mg/L	
			Dissolved Copper (Cu)	2021/09/21	<0.00020		mg/L	
			Dissolved Lead (Pb)	2021/09/21	<0.00020		mg/L	
			Dissolved Antimony (Sb)	2021/09/21	<0.00060		mg/L	
			Dissolved Molybdenum (Mo)	2021/09/21	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2021/09/21	<0.00050		mg/L	
			Dissolved Selenium (Se)	2021/09/21	<0.00020		mg/L	
			Dissolved Silver (Ag)	2021/09/21	<0.00010		mg/L	
			Dissolved Arsenic (As)	2021/09/21	<0.00020		mg/L	
			Dissolved Thallium (Tl)	2021/09/21	<0.00020		mg/L	
			Dissolved Tin (Sn)	2021/09/21	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2021/09/21	<0.0010		mg/L	
			Dissolved Uranium (U)	2021/09/21	<0.00010		mg/L	
			Dissolved Vanadium (V)	2021/09/21	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2021/09/21	<0.0030		mg/L	
			Dissolved Beryllium (Be)	2021/09/21	<0.0010		mg/L	
A359319	MPU	Method Blank	Dissolved Iron (Fe)	2021/09/23	<0.060		mg/L	
			Dissolved Lithium (Li)	2021/09/23	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2021/09/23	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/09/23	<0.0040		mg/L	
			Dissolved Potassium (K)	2021/09/23	<0.30		mg/L	
			Dissolved Sodium (Na)	2021/09/23	<0.50		mg/L	
			Dissolved Strontium (Sr)	2021/09/23	<0.020		mg/L	
			Dissolved Sulphur (S)	2021/09/23	<0.20		mg/L	
			Dissolved Phosphorus (P)	2021/09/23	<0.10		mg/L	
			Dissolved Barium (Ba)	2021/09/23	<0.010		mg/L	

BUREAU
VERITASBV Labs Job #: C169894
Report Date: 2021/09/27

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Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872-21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Silicon (Si)	2021/09/23	<0.10		mg/L	
			Dissolved Boron (B)	2021/09/23	<0.020		mg/L	
			Dissolved Calcium (Ca)	2021/09/23	<0.30		mg/L	
A359379	TMU	Method Blank	Phenols	2021/09/21	<0.0015		mg/L	
A359380	TMU	Method Blank	Phenols	2021/09/21	<0.0015		mg/L	
A360985	LT	Method Blank	Total Dissolved Solids	2021/09/23	<10		mg/L	
A363090	RK3	Method Blank	Dissolved Mercury (Hg)	2021/09/23	<0.0019		ug/L	
A363859	NR	Method Blank	Dissolved Chloride (Cl)	2021/09/23	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/09/23	<1.0		mg/L	
A358478	SEH	LCS	O-TERPHENYL (sur.)	2021/09/24		100	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/24		94	%	60 - 140
A358684	DO1	LCS	1,4-Difluorobenzene (sur.)	2021/09/23		102	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/23		98	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/23		101	%	50 - 140
			Benzene	2021/09/23		97	%	60 - 130
			Toluene	2021/09/23		102	%	60 - 130
			Ethylbenzene	2021/09/23		98	%	60 - 130
			m & p-Xylene	2021/09/23		104	%	60 - 130
			o-Xylene	2021/09/23		103	%	60 - 130
			F1 (C6-C10)	2021/09/23		96	%	60 - 140
A358861	IKO	LCS	Alkalinity (Total as CaCO3)	2021/09/21		102	%	80 - 120
A358863	IKO	LCS	Conductivity	2021/09/20		103	%	90 - 110
A358864	IKO	LCS	Dissolved Fluoride (F)	2021/09/20		91	%	80 - 120
A359004	JFH	LCS	Dissolved Nitrite (N)	2021/09/20		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/20		100	%	80 - 120
A359021	JFH	LCS	Dissolved Nitrite (N)	2021/09/20		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/20		102	%	80 - 120
A359027	JFH	LCS	Dissolved Nitrite (N)	2021/09/20		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/20		100	%	80 - 120
A359137	LQ1	LCS	Dissolved Aluminum (Al)	2021/09/21		96	%	80 - 120
			Dissolved Chromium (Cr)	2021/09/21		98	%	80 - 120
			Dissolved Cobalt (Co)	2021/09/21		100	%	80 - 120
			Dissolved Copper (Cu)	2021/09/21		100	%	80 - 120
			Dissolved Lead (Pb)	2021/09/21		100	%	80 - 120
			Dissolved Antimony (Sb)	2021/09/21		106	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/09/21		104	%	80 - 120
			Dissolved Nickel (Ni)	2021/09/21		99	%	80 - 120
			Dissolved Selenium (Se)	2021/09/21		98	%	80 - 120
			Dissolved Silver (Ag)	2021/09/21		102	%	80 - 120
			Dissolved Arsenic (As)	2021/09/21		95	%	80 - 120
			Dissolved Thallium (Tl)	2021/09/21		97	%	80 - 120
			Dissolved Tin (Sn)	2021/09/21		105	%	80 - 120
			Dissolved Titanium (Ti)	2021/09/21		85	%	80 - 120
			Dissolved Uranium (U)	2021/09/21		99	%	80 - 120
			Dissolved Vanadium (V)	2021/09/21		99	%	80 - 120
			Dissolved Zinc (Zn)	2021/09/21		122 (1)	%	80 - 120
			Dissolved Beryllium (Be)	2021/09/21		92	%	80 - 120
A359319	MPU	LCS	Dissolved Iron (Fe)	2021/09/23		93	%	80 - 120
			Dissolved Lithium (Li)	2021/09/23		92	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/23		93	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/23		94	%	80 - 120
			Dissolved Potassium (K)	2021/09/23		94	%	80 - 120



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BV Labs Job #: C169894
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
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Project #: 417085-31872-21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Sodium (Na)	2021/09/23		91	%	80 - 120
			Dissolved Strontium (Sr)	2021/09/23		92	%	80 - 120
			Dissolved Sulphur (S)	2021/09/23		88	%	80 - 120
			Dissolved Phosphorus (P)	2021/09/23		88	%	80 - 120
			Dissolved Barium (Ba)	2021/09/23		94	%	80 - 120
			Dissolved Silicon (Si)	2021/09/23		85	%	80 - 120
			Dissolved Boron (B)	2021/09/23		100	%	80 - 120
			Dissolved Calcium (Ca)	2021/09/23		92	%	80 - 120
A359379	TMU	LCS	Phenols	2021/09/21		97	%	80 - 120
A359380	TMU	LCS	Phenols	2021/09/21		98	%	80 - 120
A360985	LT	LCS	Total Dissolved Solids	2021/09/23		88	%	80 - 120
A363090	RK3	LCS	Dissolved Mercury (Hg)	2021/09/23		106	%	80 - 120
A363859	NR	LCS	Dissolved Chloride (Cl)	2021/09/23		104	%	80 - 120
			Dissolved Sulphate (SO ₄)	2021/09/23		101	%	80 - 120

LCS: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



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BV Labs Job #: C169894
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Gita Pokhrel, Laboratory Supervisor

Janet Gao, B.Sc., QP, Supervisor, Organics

Sze Yeung Fock, B.Sc., Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

INVOICE INFORMATION				REPORT INFORMATION				ANALYSIS REQUESTED																							
Company Name: ☒ Imperial Oil ☐ ExxonMobil				Company Name: <u>Worley</u>				PHCs (FRACTIONS 1-2 PLUS BTX) PHCs (FRACTIONS 1-4 PLUS BTX) PHCs (FRACTIONS 2-4) PHCs (FRACTION 1 PLUS BTX) GRAIN SIZE (75 MICRON) TEXTURE (% SAND, SILT, CLAY) PARTICLE SIZE DISTRIBUTION WITH GRAPH REGULATED METALS TOT ☒ DIS ☒ MERCURY TOTAL ☐ DISSOLVED ☒ SALINITY SOIL FERTILIZER SOIL FERTILIZER WATER NUTRIENTS SOIL ROUTINE POTABILITY pH ☐ EC ☐ ALKALINITY ☐ BASIC CLASS II LANDFILL PKG Total Phenols Fluoride Limited Sample																							
Contact Name: <u>Alex Haigh</u>				Contact Name: <u>Alex Haigh</u>																											
Address: <u>150, 205 Quarry Park Blvd</u> <u>Calgary, AB T2C 3E7</u>				Address: <u>150, 205 Quarry Park Blvd</u> <u>Calgary, AB T2C 3E7</u>																											
Email: <u>alex.haigh@advisian.com</u>				Email: <u>alex.haigh@advisian.com</u>																											
Ph: <u>587-897-6249</u>				Ph: <u>587-897-6249</u>																											
Sampler Name (Print): <u>Stacy Gibb/Douglas Haney</u>				Consultant Project #: <u>417085-31872-21100</u>																											
FIELD SAMPLE ID	MATRIX				# CONTAINERS	SAMPLING		FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	VOC	PAH	PHCs (FRACTIONS 1-2 PLUS BTX)	PHCs (FRACTIONS 1-4 PLUS BTX)	PHCs (FRACTIONS 2-4)	PHCs (FRACTION 1 PLUS BTX)	GRAIN SIZE (75 MICRON)	TEXTURE (% SAND, SILT, CLAY)	PARTICLE SIZE DISTRIBUTION WITH GRAPH	REGULATED METALS TOT ☒ DIS ☒	MERCURY TOTAL ☐ DISSOLVED ☒	SALINITY SOIL	FERTILIZER SOIL	FERTILIZER WATER	NUTRIENTS SOIL	ROUTINE POTABILITY	pH ☐ EC ☐ ALKALINITY ☐	BASIC CLASS II LANDFILL PKG	Total Phenols	Fluoride	Limited Sample	
	GROUND WATER	SURFACE WATER	SOIL	OTHER		DATE (YYYY/MM/DD)	TIME (24 HR)																								
1 MTF 97-1-5	✓				9	2021/09/15 12:20	X					X							X	X					X		X	X			
2 TF 03-12-3	✓				9	2021/09/15 10:35	X					X							X	X					X		X	X			
3 SNP-21-DUP1	✓				9	2021/09/15 10:40	X					X							X	X					X		X	X			
4 MEBG-10-1-3	✓				9	2021/09/15 11:55	X					X							X	X					X		X	X			
5 ARB-12-3-3	✓				9	2021/09/15 11:10	X					X																			X
6 WSY 97-1-5	✓				3	2021/09/15 11:30	X					X																			
7																															
8																															
9																															
10																															

IOL SITE LOCATION Norman Wells, NT

IOL PROJECT # (if applicable) N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM
417085-31872-21100

REGULATORY CRITERIA / DETECTION LIMITS:

☐ Alberta Tier 1 ☐ CDWG

☐ SEQG (SK) ☐ NoSC (SK)

☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS

Email Canada.chemistry@worley.com

Canada For data track@worley.com

JARS USED & NOT SUBMITTED
Enter N/A for Water

N/A

TURNAROUND TIME

Standard (5 days) ☒

Rush (3 days) ☐

(2 days) ☐

(1 day) ☐

(same day) ☐

Date Required

LAB USE ONLY

MAXXAM JOB # C169894

SEAL PRESENT ☒

SEAL INTACT ☒

COOLING MEDIA PRESENT ☒

TEMP °C 0 0 1

DATE: 2021/09/17 TIME (24 HR) 11:30

RECEIVED BY: Dawit Kibreab

DATE: 2021/09/18 TIME (24 HR) 14:50

RELINQUISHED BY: STACY GIBB

LABELED BY: FJM

VERIFIED BY: DKR

DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: <u>Advisian</u>	Sampling Date: <u>15-Sep-21</u>
Location: <u>Norman Wells</u>	Laboratory : <u>Bureau Veritas Calgary</u>
Consultant Project Number: <u>417085-31872-21100</u>	Sample Submission Number: <u>C169895</u>

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Instrument Surrogate Recovery	x			Laboratory control sample recovery of Dissolved Zinc (Zn) (122%) did not meet acceptance criteria (80-120%) for sample A359137. All other laboratory QC met acceptance criteria.
Extraction Surrogate Recovery	x			
Method Blank Concentration	x			
Matrix Duplicate RPD	x			
Matrix Spike Recovery	x			
Lab Control Sample Recovery		x		

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Field Blank Concentration			x	No field QC samples submitted.
Trip Blank Concentration			x	
Equipment Blank Concentration			x	
Field Duplicate RPD			x	

Has CoA been signed off (Yes/No)?:

Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?:

Were all samples analyzed within hold times (Yes/No)?:

All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?:

Is Chain of Custody completed and signed (Yes/No)?:

Were sample temperatures acceptable when they reached lab (Yes/No)?:

	<u>Yes</u>
	<u>Yes</u>
	<u>No</u>
	<u>n/a</u>
	<u>Yes</u>
	<u>Yes</u>

Was a Data Quality Overview (DQO) issued (Yes/No)?:

Date DQO was received: 27-Sep-21

Is data considered to be reliable (Yes/No)?:

If answer is "No", describe and provide rationale:

Yes

Data Reviewed by (Print): <u>dheenarama KR</u>	Data Reviewed by (Signature): <u></u>
Date: <u>15-Nov-21</u>	

**Attention: Alex Haigh**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100
Your C.O.C. #: 299450

Report Date: 2021/09/27
Report #: R3076889
Version: 1 - Final

CERTIFICATE OF ANALYSIS**BV LABS JOB #: C169895****Received: 2021/09/18, 14:50**

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	4	AB SOP-00005	SM 23 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	4	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	4		Auto Calc
Cadmium - low level CCME - Dissolved	4		Auto Calc
Chloride/Sulphate by Auto Colourimetry	4	AB SOP-00020	SM23-4500-Cl/SO ₄ -E m
Conductivity @25C	4	AB SOP-00005	SM 23 2510 B m
Fluoride	4	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons in Water (F2; C10-C16) (1)	4	AB SOP-00037 AB SOP-00040	CCME PHC-CWS m
Hardness	4		Auto Calc
Mercury (Dissolved) by CV (2)	4	AB SOP-00084	BCMOE BCLM Oct2013 m
Elements by ICP - Dissolved (2)	4	AB SOP-00042	EPA 6010d R5 m
Elements by ICPMS - Dissolved (2)	4	AB SOP-00043	EPA 6020b R2 m
Ion Balance	4		Auto Calc
Nitrate and Nitrite	4		Auto Calc
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	4	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	4		Auto Calc
Phenols (4-AAP)	4	AB SOP-00088	EPA 9066 R0 m
Total Dissolved Solids (Filt. Residue)	4	AB SOP-00065	SM 23 2540 C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless



Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100
Your C.O.C. #: 299450

Attention: Alex Haigh

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Report Date: 2021/09/27
Report #: R3076889
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C169895

Received: 2021/09/18, 14:50

otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Silica gel clean up employed.

(2) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Namita Sahni
Customer Solutions Representative
27 Sep 2021 13:10:45

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Namita Sahni, Customer Solutions Representative

Email: Namita.Sahni@bureauveritas.com

Phone# (604)639-2614

=====

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



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BV Labs Job #: C169895
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

AT1 BTEX AND F1-F2 IN WATER (WATER)

BV Labs ID		AGG935	AGG936	AGG937	AGG938			AGG938		
Sampling Date		2021/09/15 14:25	2021/09/15 14:30	2021/09/15 14:50	2021/09/15 12:35			2021/09/15 12:35		
COC Number		299450	299450	299450	299450			299450		
	UNITS	CPF 98-8-3	SNP-21-DUP2	CPF 97-7-5	C38 08-1-4	RDL	QC Batch	C38 08-1-4 Lab-Dup	RDL	QC Batch
Ext. Pet. Hydrocarbon										
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A358478	<0.10	0.10	A358478
Volatiles										
Benzene	mg/L	<0.00040	<0.00040	<0.00040	0.00053	0.00040	A358684			
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A358684			
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A358684			
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	A358684			
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	A358684			
Xylenes (Total)	mg/L	<0.00089	<0.00089	<0.00089	<0.00089	0.00089	A357868			
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A357868			
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A358684			
Extraction										
Surrogate Recovery (%)										
O-TERPHENYL (sur.)	%	105	104	95	104		A358478	103		A358478
Instrument										
Surrogate Recovery (%)										
1,4-Difluorobenzene (sur.)	%	102	101	101	101		A358684			
4-Bromofluorobenzene (sur.)	%	97	96	99	99		A358684			
D4-1,2-Dichloroethane (sur.)	%	101	102	99	98		A358684			
RDL = Reportable Detection Limit										
Lab-Dup = Laboratory Initiated Duplicate										

BUREAU
VERITASBV Labs Job #: C169895
Report Date: 2021/09/27

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872-21100

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AGG935			AGG935			AGG936		
Sampling Date		2021/09/15 14:25			2021/09/15 14:25			2021/09/15 14:30		
COC Number		299450			299450			299450		
	UNITS	CPF 98-8-3	RDL	QC Batch	CPF 98-8-3 Lab-Dup	RDL	QC Batch	SNP-21-DUP2	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO ₃)	mg/L	620	0.50	A357881				660	0.50	A357881
Ion Balance (% Difference)	%	0.82	N/A	A357882				0.59	N/A	A357882
Dissolved Nitrate (N)	mg/L	<0.010	0.010	A357887				0.015	0.010	A357887
Dissolved Nitrate (NO ₃)	mg/L	<0.044	0.044	A357886				0.065	0.044	A357886
Dissolved Nitrite (NO ₂)	mg/L	0.037	0.033	A357886				<0.033	0.033	A357886
Elements										
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	A357878				<0.000020	0.000020	A357878
Misc. Inorganics										
Conductivity	uS/cm	1100	2.0	A360090				1200	2.0	A360082
Total Dissolved Solids	mg/L	770	10	A360987	760	10	A360987	780	10	A360987
Anions										
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A360087				<1.0	1.0	A360039
Alkalinity (Total as CaCO ₃)	mg/L	440	1.0	A360087				440	1.0	A360039
Bicarbonate (HCO ₃)	mg/L	540	1.0	A360087				540	1.0	A360039
Carbonate (CO ₃)	mg/L	<1.0	1.0	A360087				<1.0	1.0	A360039
Dissolved Fluoride (F)	mg/L	0.057	0.050	A360091				0.057	0.050	A360083
Hydroxide (OH)	mg/L	<1.0	1.0	A360087				<1.0	1.0	A360039
Dissolved Chloride (Cl)	mg/L	8.3	1.0	A364300				8.1	1.0	A364300
Dissolved Sulphate (SO ₄)	mg/L	200	5.0	A364300				220	5.0	A364300
Nutrients										
Dissolved Nitrite (N)	mg/L	0.011	0.010	A358992				<0.010	0.010	A358992
Dissolved Nitrate plus Nitrite (N)	mg/L	<0.010	0.010	A358992				0.015	0.010	A358992
Misc. Organics										
Phenols	mg/L	<0.0015	0.0015	A359380				<0.0015	0.0015	A359380
RDL = Reportable Detection Limit										
Lab-Dup = Laboratory Initiated Duplicate										
N/A = Not Applicable										

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VERITASBV Labs Job #: C169895
Report Date: 2021/09/27

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872-21100

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AGG937			AGG937			AGG938		
Sampling Date		2021/09/15 14:50			2021/09/15 14:50			2021/09/15 12:35		
COC Number		299450			299450			299450		
	UNITS	CPF 97-7-5	RDL	QC Batch	CPF 97-7-5 Lab-Dup	RDL	QC Batch	C38 08-1-4	RDL	QC Batch
Calculated Parameters										
Hardness (CaCO ₃)	mg/L	1300	0.50	A357881				570	0.50	A357881
Ion Balance (% Difference)	%	1.9	N/A	A357882				0.88	N/A	A357882
Dissolved Nitrate (N)	mg/L	<0.050	0.050	A357887				<0.050	0.050	A357887
Dissolved Nitrate (NO ₃)	mg/L	<0.22	0.22	A357886				<0.22	0.22	A357886
Dissolved Nitrite (NO ₂)	mg/L	<0.033	0.033	A357886				<0.033	0.033	A357886
Elements										
Dissolved Cadmium (Cd)	mg/L	0.00026	0.000020	A357878				<0.000020	0.000020	A357878
Misc. Inorganics										
Conductivity	uS/cm	2200	2.0	A360082				1200	2.0	A360082
Total Dissolved Solids	mg/L	1900	10	A360987				520 (1)	25	A360987
Anions										
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A360039				<1.0	1.0	A360039
Alkalinity (Total as CaCO ₃)	mg/L	310	1.0	A360039				660	1.0	A360039
Bicarbonate (HCO ₃)	mg/L	380	1.0	A360039				800	1.0	A360039
Carbonate (CO ₃)	mg/L	<1.0	1.0	A360039				<1.0	1.0	A360039
Dissolved Fluoride (F)	mg/L	0.083	0.050	A360083				0.088	0.050	A360083
Hydroxide (OH)	mg/L	<1.0	1.0	A360039				<1.0	1.0	A360039
Dissolved Chloride (Cl)	mg/L	9.9	1.0	A364300				16	1.0	A364300
Dissolved Sulphate (SO ₄)	mg/L	1100	10	A364300				<1.0	1.0	A364300
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A358992	<0.010	0.010	A358992	<0.010	0.010	A358992
Dissolved Nitrate plus Nitrite (N)	mg/L	<0.050 (2)	0.050	A358992	<0.050 (2)	0.050	A358992	<0.050 (2)	0.050	A358992
Misc. Organics										
Phenols	mg/L	<0.0015	0.0015	A359380				0.0035	0.0015	A359380

RDL = Reportable Detection Limit

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable

(1) Detection limit raised based on sample volume used for analysis.

(2) Detection limits raised due to matrix interference.



BUREAU
VERITAS

BV Labs Job #: C169895
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

MERCURY BY COLD VAPOR (WATER)

BV Labs ID		AGG935	AGG936	AGG937	AGG938		
Sampling Date		2021/09/15 14:25	2021/09/15 14:30	2021/09/15 14:50	2021/09/15 12:35		
COC Number		299450	299450	299450	299450		
	UNITS	CPF 98-8-3	SNP-21-DUP2	CPF 97-7-5	C38 08-1-4	RDL	QC Batch
Elements							
Dissolved Mercury (Hg)	ug/L	0.0036	0.0037	0.0026	0.0069	0.0019	A363090
RDL = Reportable Detection Limit							



BV Labs Job #: C169895
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGG935	AGG936	AGG937	AGG938		
Sampling Date		2021/09/15 14:25	2021/09/15 14:30	2021/09/15 14:50	2021/09/15 12:35		
COC Number		299450	299450	299450	299450		
	UNITS	CPF 98-8-3	SNP-21-DUP2	CPF 97-7-5	C38 08-1-4	RDL	QC Batch
Elements							
Dissolved Aluminum (Al)	mg/L	0.036	0.044	0.033	0.078	0.0030	A359137
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	0.00098	0.00060	A359137
Dissolved Arsenic (As)	mg/L	0.00051	0.00058	0.00038	0.0043	0.00020	A359137
Dissolved Barium (Ba)	mg/L	0.20	0.21	0.061	0.30	0.010	A359319
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A359137
Dissolved Boron (B)	mg/L	0.025	0.023	0.053	<0.020	0.020	A359319
Dissolved Calcium (Ca)	mg/L	190	200	400	150	0.30	A359319
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A359137
Dissolved Cobalt (Co)	mg/L	0.0015	0.0017	0.0040	0.0027	0.00030	A359137
Dissolved Copper (Cu)	mg/L	0.00090	0.00041	0.0034	0.0015	0.00020	A359137
Dissolved Iron (Fe)	mg/L	0.44	0.47	0.85	12	0.060	A359319
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	0.00022	0.00020	A359137
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	<0.020	0.022	0.020	A359319
Dissolved Magnesium (Mg)	mg/L	38	40	83	50	0.20	A359319
Dissolved Manganese (Mn)	mg/L	1.0	1.1	2.1	0.58	0.0040	A359319
Dissolved Molybdenum (Mo)	mg/L	0.00037	0.00047	0.0017	<0.00020	0.00020	A359137
Dissolved Nickel (Ni)	mg/L	0.0030	0.0031	0.0072	0.0040	0.00050	A359137
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	0.42	0.10	A359319
Dissolved Potassium (K)	mg/L	2.4	2.4	4.9	3.3	0.30	A359319
Dissolved Selenium (Se)	mg/L	<0.00020	<0.00020	<0.00020	0.00047	0.00020	A359137
Dissolved Silicon (Si)	mg/L	4.1	4.2	4.0	8.2	0.10	A359319
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A359137
Dissolved Sodium (Na)	mg/L	14	14	9.5	32	0.50	A359319
Dissolved Strontium (Sr)	mg/L	0.74	0.77	1.6	0.42	0.020	A359319
Dissolved Sulphur (S)	mg/L	64	67	320	2.0	0.20	A359319
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	A359137
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A359137
Dissolved Titanium (Ti)	mg/L	0.0012	0.0015	0.0012	0.0026	0.0010	A359137
Dissolved Uranium (U)	mg/L	0.00081	0.00085	0.0021	0.00027	0.00010	A359137
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	0.0013	0.0010	A359137
Dissolved Zinc (Zn)	mg/L	0.0080	0.0065	0.023	0.0077	0.0030	A359137
RDL = Reportable Detection Limit							



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BV Labs Job #: C169895
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

TEST SUMMARY

BV Labs ID: AGG935
Sample ID: CPF 98-8-3
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A360087	N/A	2021/09/21	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A358684	N/A	2021/09/23	Darrus Ong
F1-BTEX	CALC/MS	A357868	N/A	2021/09/24	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A357878	N/A	2021/09/21	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A364300	N/A	2021/09/24	Bradley Freake
Conductivity @25C	COND	A360090	N/A	2021/09/21	Ilonka Kovac
Fluoride	AT	A360091	N/A	2021/09/21	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini
Hardness	CALC	A357881	N/A	2021/09/24	Automated Statchk
Mercury (Dissolved) by CV	CV	A363090	2021/09/23	2021/09/23	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A359319	N/A	2021/09/23	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A359137	N/A	2021/09/21	Lesley Quan
Ion Balance	CALC	A357882	N/A	2021/09/24	Automated Statchk
Nitrate and Nitrite	CALC	A357886	N/A	2021/09/21	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A358992	N/A	2021/09/20	Jacqueline Fahrner
Nitrate (as N)	CALC	A357887	2021/09/21	2021/09/21	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A359380	N/A	2021/09/21	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A360987	2021/09/22	2021/09/23	Lisa Thum

BV Labs ID: AGG935 Dup
Sample ID: CPF 98-8-3
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Dissolved Solids (Filt. Residue)	BAL	A360987	2021/09/22	2021/09/23	Lisa Thum

BV Labs ID: AGG936
Sample ID: SNP-21-DUP2
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A360039	N/A	2021/09/21	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A358684	N/A	2021/09/23	Darrus Ong
F1-BTEX	CALC/MS	A357868	N/A	2021/09/24	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A357878	N/A	2021/09/21	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A364300	N/A	2021/09/24	Bradley Freake
Conductivity @25C	COND	A360082	N/A	2021/09/21	Ilonka Kovac
Fluoride	AT	A360083	N/A	2021/09/21	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini
Hardness	CALC	A357881	N/A	2021/09/24	Automated Statchk
Mercury (Dissolved) by CV	CV	A363090	2021/09/23	2021/09/23	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A359319	N/A	2021/09/23	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A359137	N/A	2021/09/21	Lesley Quan
Ion Balance	CALC	A357882	N/A	2021/09/24	Automated Statchk



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BV Labs Job #: C169895
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

TEST SUMMARY

BV Labs ID: AGG936
Sample ID: SNP-21-DUP2
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate and Nitrite	CALC	A357886	N/A	2021/09/21	Automated Statchk
NO2 (N); NO2 (N) + NO3 (N) in Water	AC/COL	A358992	N/A	2021/09/20	Jacqueline Fahrner
Nitrate (as N)	CALC	A357887	2021/09/21	2021/09/21	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A359380	N/A	2021/09/21	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A360987	2021/09/22	2021/09/23	Lisa Thum

BV Labs ID: AGG937
Sample ID: CPF 97-7-5
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO3,HCO3,OH	AT/ALK	A360039	N/A	2021/09/21	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A358684	N/A	2021/09/23	Darrus Ong
F1-BTEX	CALC/MS	A357868	N/A	2021/09/24	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A357878	N/A	2021/09/21	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A364300	N/A	2021/09/24	Bradley Freake
Conductivity @25C	COND	A360082	N/A	2021/09/21	Ilonka Kovac
Fluoride	AT	A360083	N/A	2021/09/21	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini
Hardness	CALC	A357881	N/A	2021/09/24	Automated Statchk
Mercury (Dissolved) by CV	CV	A363090	2021/09/23	2021/09/23	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A359319	N/A	2021/09/23	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A359137	N/A	2021/09/21	Lesley Quan
Ion Balance	CALC	A357882	N/A	2021/09/24	Automated Statchk
Nitrate and Nitrite	CALC	A357886	N/A	2021/09/21	Automated Statchk
NO2 (N); NO2 (N) + NO3 (N) in Water	AC/COL	A358992	N/A	2021/09/20	Jacqueline Fahrner
Nitrate (as N)	CALC	A357887	2021/09/21	2021/09/21	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A359380	N/A	2021/09/21	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A360987	2021/09/22	2021/09/23	Lisa Thum

BV Labs ID: AGG937 Dup
Sample ID: CPF 97-7-5
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
NO2 (N); NO2 (N) + NO3 (N) in Water	AC/COL	A358992	N/A	2021/09/20	Jacqueline Fahrner

BV Labs ID: AGG938
Sample ID: C38 08-1-4
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO3,HCO3,OH	AT/ALK	A360039	N/A	2021/09/21	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A358684	N/A	2021/09/23	Darrus Ong
F1-BTEX	CALC/MS	A357868	N/A	2021/09/24	Automated Statchk



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BV Labs Job #: C169895
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

TEST SUMMARY

BV Labs ID: AGG938
Sample ID: C38 08-1-4
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Cadmium - low level CCME - Dissolved	CALC/MS	A357878	N/A	2021/09/21	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A364300	N/A	2021/09/24	Bradley Freake
Conductivity @25C	COND	A360082	N/A	2021/09/21	Ilonka Kovac
Fluoride	AT	A360083	N/A	2021/09/21	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini
Hardness	CALC	A357881	N/A	2021/09/24	Automated Statchk
Mercury (Dissolved) by CV	CV	A363090	2021/09/23	2021/09/23	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A359319	N/A	2021/09/23	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A359137	N/A	2021/09/21	Lesley Quan
Ion Balance	CALC	A357882	N/A	2021/09/24	Automated Statchk
Nitrate and Nitrite	CALC	A357886	N/A	2021/09/21	Automated Statchk
NO2 (N); NO2 (N) + NO3 (N) in Water	AC/COL	A358992	N/A	2021/09/20	Jacqueline Fahrner
Nitrate (as N)	CALC	A357887	2021/09/21	2021/09/21	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A359380	N/A	2021/09/21	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A360987	2021/09/22	2021/09/23	Lisa Thum

BV Labs ID: AGG938 Dup
Sample ID: C38 08-1-4
Matrix: Water

Collected: 2021/09/15
Relinquished: 2021/09/17
Received: 2021/09/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A358478	2021/09/21	2021/09/24	Seyedsajjad Hosseini

**GENERAL COMMENTS**

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.0°C
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Sample AGG935 [CPF 98-8-3] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Sample AGG936 [SNP-21-DUP2] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Sample AGG937 [CPF 97-7-5] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Sample AGG938 [C38 08-1-4] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Results relate only to the items tested.

DATA QUALITY OVERVIEW

Lab ID	Client Sample ID	Matrix	Test Code	Analysis Type	Parameters	Deviation	Root Cause	Potential Impact
AGG935	CPF 98-8-3	Water	NO23AC-W	NUTS	Sample	#10 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.
AGG936	SNP-21-DUP2	Water	NO23AC-W	NUTS	Sample	#10 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.
AGG937	CPF 97-7-5	Water	NO23AC-W	NUTS	Sample	#10 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.
AGG938	C38 08-1-4	Water	NO23AC-W	NUTS	Sample	#10 Past Hold Time	#10 Lab Error	This may increase the uncertainty associated with these results.

BUREAU
VERITASBV Labs Job #: C169895
Report Date: 2021/09/27Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A358478	SEH	Method Blank	O-TERPHENYL (sur.)	2021/09/24		102	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/24	<0.10		mg/L	
A358684	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2021/09/23		100	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/23		96	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/23		97	%	50 - 140
			Benzene	2021/09/23	<0.00040		mg/L	
			Toluene	2021/09/23	<0.00040		mg/L	
			Ethylbenzene	2021/09/23	<0.00040		mg/L	
			m & p-Xylene	2021/09/23	<0.00080		mg/L	
			o-Xylene	2021/09/23	<0.00040		mg/L	
			F1 (C6-C10)	2021/09/23	<0.10		mg/L	
A358992	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/20	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/20	<0.010		mg/L	
A359137	LQ1	Method Blank	Dissolved Aluminum (Al)	2021/09/21	<0.0030		mg/L	
			Dissolved Chromium (Cr)	2021/09/21	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2021/09/21	<0.00030		mg/L	
			Dissolved Copper (Cu)	2021/09/21	<0.00020		mg/L	
			Dissolved Lead (Pb)	2021/09/21	<0.00020		mg/L	
			Dissolved Antimony (Sb)	2021/09/21	<0.00060		mg/L	
			Dissolved Molybdenum (Mo)	2021/09/21	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2021/09/21	<0.00050		mg/L	
			Dissolved Selenium (Se)	2021/09/21	<0.00020		mg/L	
			Dissolved Silver (Ag)	2021/09/21	<0.00010		mg/L	
			Dissolved Arsenic (As)	2021/09/21	<0.00020		mg/L	
			Dissolved Thallium (Tl)	2021/09/21	<0.00020		mg/L	
			Dissolved Tin (Sn)	2021/09/21	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2021/09/21	<0.0010		mg/L	
			Dissolved Uranium (U)	2021/09/21	<0.00010		mg/L	
			Dissolved Vanadium (V)	2021/09/21	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2021/09/21	<0.0030		mg/L	
			Dissolved Beryllium (Be)	2021/09/21	<0.0010		mg/L	
A359319	MPU	Method Blank	Dissolved Iron (Fe)	2021/09/23	<0.060		mg/L	
			Dissolved Lithium (Li)	2021/09/23	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2021/09/23	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/09/23	<0.0040		mg/L	
			Dissolved Potassium (K)	2021/09/23	<0.30		mg/L	
			Dissolved Sodium (Na)	2021/09/23	<0.50		mg/L	
			Dissolved Strontium (Sr)	2021/09/23	<0.020		mg/L	
			Dissolved Sulphur (S)	2021/09/23	<0.20		mg/L	
			Dissolved Phosphorus (P)	2021/09/23	<0.10		mg/L	
			Dissolved Barium (Ba)	2021/09/23	<0.010		mg/L	
			Dissolved Silicon (Si)	2021/09/23	<0.10		mg/L	
			Dissolved Boron (B)	2021/09/23	<0.020		mg/L	
			Dissolved Calcium (Ca)	2021/09/23	<0.30		mg/L	
A359380	TMU	Method Blank	Phenols	2021/09/21	<0.0015		mg/L	
A360039	IKO	Method Blank	Alkalinity (Total as CaCO3)	2021/09/21	<1.0		mg/L	
			Alkalinity (PP as CaCO3)	2021/09/21	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/09/21	<1.0		mg/L	
			Carbonate (CO3)	2021/09/21	<1.0		mg/L	
			Hydroxide (OH)	2021/09/21	<1.0		mg/L	
A360082	IKO	Method Blank	Conductivity	2021/09/21	<2.0		uS/cm	
A360083	IKO	Method Blank	Dissolved Fluoride (F)	2021/09/21	<0.050		mg/L	



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BV Labs Job #: C169895
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A360087	IKO	Method Blank	Alkalinity (Total as CaCO ₃)	2021/09/21	<1.0		mg/L	
			Alkalinity (PP as CaCO ₃)	2021/09/21	<1.0		mg/L	
			Bicarbonate (HCO ₃)	2021/09/21	<1.0		mg/L	
			Carbonate (CO ₃)	2021/09/21	<1.0		mg/L	
			Hydroxide (OH)	2021/09/21	<1.0		mg/L	
A360090	IKO	Method Blank	Conductivity	2021/09/21	<2.0		uS/cm	
A360091	IKO	Method Blank	Dissolved Fluoride (F)	2021/09/21	<0.050		mg/L	
A360987	LT	Method Blank	Total Dissolved Solids	2021/09/23	<10		mg/L	
A363090	RK3	Method Blank	Dissolved Mercury (Hg)	2021/09/23	<0.0019		ug/L	
A364300	BFE	Method Blank	Dissolved Chloride (Cl)	2021/09/24	<1.0		mg/L	
			Dissolved Sulphate (SO ₄)	2021/09/24	<1.0		mg/L	
A360987	LT	RPD [AGG935-01]	Total Dissolved Solids	2021/09/23	0.52		%	20
A358992	JFH	RPD [AGG937-01]	Dissolved Nitrite (N)	2021/09/20	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/09/20	NC (1)		%	20
A358478	SEH	RPD [AGG938-05]	F2 (C10-C16 Hydrocarbons)	2021/09/24	NC		%	30
A358992	JFH	Matrix Spike [AGG937-01]	Dissolved Nitrite (N)	2021/09/20		97	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/20		87	%	80 - 120
A360987	LT	Matrix Spike [AGG936-01]	Total Dissolved Solids	2021/09/23		NC	%	80 - 120
A358478	SEH	LCS	O-TERPHENYL (sur.)	2021/09/24		100	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/24		94	%	60 - 140
A358684	DO1	LCS	1,4-Difluorobenzene (sur.)	2021/09/23		102	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/23		98	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/23		101	%	50 - 140
			Benzene	2021/09/23		97	%	60 - 130
			Toluene	2021/09/23		102	%	60 - 130
			Ethylbenzene	2021/09/23		98	%	60 - 130
			m & p-Xylene	2021/09/23		104	%	60 - 130
			o-Xylene	2021/09/23		103	%	60 - 130
			F1 (C6-C10)	2021/09/23		96	%	60 - 140
A358992	JFH	LCS	Dissolved Nitrite (N)	2021/09/20		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/20		108	%	80 - 120
A359137	LQ1	LCS	Dissolved Aluminum (Al)	2021/09/21		96	%	80 - 120
			Dissolved Chromium (Cr)	2021/09/21		98	%	80 - 120
			Dissolved Cobalt (Co)	2021/09/21		100	%	80 - 120
			Dissolved Copper (Cu)	2021/09/21		100	%	80 - 120
			Dissolved Lead (Pb)	2021/09/21		100	%	80 - 120
			Dissolved Antimony (Sb)	2021/09/21		106	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/09/21		104	%	80 - 120
			Dissolved Nickel (Ni)	2021/09/21		99	%	80 - 120
			Dissolved Selenium (Se)	2021/09/21		98	%	80 - 120
			Dissolved Silver (Ag)	2021/09/21		102	%	80 - 120
			Dissolved Arsenic (As)	2021/09/21		95	%	80 - 120
			Dissolved Thallium (Tl)	2021/09/21		97	%	80 - 120
			Dissolved Tin (Sn)	2021/09/21		105	%	80 - 120
			Dissolved Titanium (Ti)	2021/09/21		85	%	80 - 120
			Dissolved Uranium (U)	2021/09/21		99	%	80 - 120
			Dissolved Vanadium (V)	2021/09/21		99	%	80 - 120
			Dissolved Zinc (Zn)	2021/09/21		122 (2)	%	80 - 120
			Dissolved Beryllium (Be)	2021/09/21		92	%	80 - 120
A359319	MPU	LCS	Dissolved Iron (Fe)	2021/09/23		93	%	80 - 120



QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Lithium (Li)	2021/09/23		92	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/23		93	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/23		94	%	80 - 120
			Dissolved Potassium (K)	2021/09/23		94	%	80 - 120
			Dissolved Sodium (Na)	2021/09/23		91	%	80 - 120
			Dissolved Strontium (Sr)	2021/09/23		92	%	80 - 120
			Dissolved Sulphur (S)	2021/09/23		88	%	80 - 120
			Dissolved Phosphorus (P)	2021/09/23		88	%	80 - 120
			Dissolved Barium (Ba)	2021/09/23		94	%	80 - 120
			Dissolved Silicon (Si)	2021/09/23		85	%	80 - 120
			Dissolved Boron (B)	2021/09/23		100	%	80 - 120
			Dissolved Calcium (Ca)	2021/09/23		92	%	80 - 120
A359380	TMU	LCS	Phenols	2021/09/21		98	%	80 - 120
A360039	IKO	LCS	Alkalinity (Total as CaCO ₃)	2021/09/21		98	%	80 - 120
A360082	IKO	LCS	Conductivity	2021/09/21		101	%	90 - 110
A360083	IKO	LCS	Dissolved Fluoride (F)	2021/09/21		86	%	80 - 120
A360087	IKO	LCS	Alkalinity (Total as CaCO ₃)	2021/09/21		97	%	80 - 120
A360090	IKO	LCS	Conductivity	2021/09/21		101	%	90 - 110
A360091	IKO	LCS	Dissolved Fluoride (F)	2021/09/21		95	%	80 - 120
A360987	LT	LCS	Total Dissolved Solids	2021/09/23		97	%	80 - 120
A363090	RK3	LCS	Dissolved Mercury (Hg)	2021/09/23		106	%	80 - 120
A364300	BFE	LCS	Dissolved Chloride (Cl)	2021/09/24		107	%	80 - 120
			Dissolved Sulphate (SO ₄)	2021/09/24		99	%	80 - 120

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

LCS: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference $\leq 2 \times \text{RDL}$).

(1) Detection limits raised due to matrix interference.

(2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



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BV Labs Job #: C169895
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872-21100

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Gita Pokhrel, Laboratory Supervisor

Janet Gao, B.Sc., QP, Supervisor, Organics

Sze Yeung Fock, B.Sc., Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

INVOICE INFORMATION				REPORT INFORMATION				ANALYSIS REQUESTED																											
Company Name: ☒ Imperial Oil ☐ ExxonMobil				Company Name: <u>Worley</u>																															
Contact Name: <u>Alex Haigh</u>				Contact Name: <u>Alex Haigh</u>																															
Address: <u>150, 205 Quarry Park Blvd SE</u>				Address: <u>150, 205 Quarry Park Blvd SE</u>																															
<u>Calgary, AB T2C 3E7</u>				<u>Calgary, AB T2C 3E7</u>																															
Email: <u>alex.haigh@advisian.com</u>				Email: <u>alex.haigh@advisian.com</u>																															
Ph: <u>587-897-6249</u>				Ph: <u>587-897-6249</u>																															
Sampler Name (Print): <u>Stacy Gibb / Doug Haney</u>				Consultant Project #: <u>417085-31872-21100</u>																															
FIELD SAMPLE ID	MATRIX				# CONTAINERS	SAMPLING		FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	VOC	PAH	PHCs (FRACTIONS 1-2 PLUS BTX)	PHCs (FRACTIONS 1-4 PLUS BTX)	PHCs (FRACTIONS 2-4)	PHCs (FRACTION 1 PLUS BTX)	GRAIN SIZE (75 MICRON)	TEXTURE (% SAND, SILT, CLAY)	PARTICLE SIZE DISTRIBUTION WITH GRAPH	REGULATED METALS	TOT	DIS	DISSOLVED	SALINITY SOIL	FERTILIZER SOIL	FERTILIZER WATER	NUTRIENTS SOIL	ROUTINE POTABILITY	pH	EC	ALKALINITY	BASIC CLASS II LANDFILL PKG	Total Phenols	Fluoride		
	GROUND WATER	SURFACE WATER	SOIL	OTHER		DATE (YYYY/MM/DD)	TIME (24 HR)																												
1 <u>CPF 98-8-3</u>	☒				9	<u>2021/09/15</u>	<u>14:25</u>	☒			☒								☒	☒							☒					☒	☒		
2 <u>SNP-21-DUP2</u>	☒				9	<u>14:30</u>	☒				☒								☒	☒							☒				☒	☒			
3 <u>CPF 97-7-5</u>	☒				9	<u>14:50</u>	☒				☒								☒	☒							☒				☒	☒			
4 <u>C38 08-1-4</u>	☒				9	<u>2021/09/15</u>	<u>12:35</u>	☒			☒								☒	☒							☒				☒	☒			
5																																			
6																																			
7																																			
8																																			
9																																			
10																																			
IOL SITE LOCATION: <u>NORMAN WELLS, NT</u>						REGULATORY CRITERIA / DETECTION LIMITS:						SPECIAL INSTRUCTIONS: <u>email: canada.chemistry@worley.com</u> <u>local: 10r data trucks@</u>						# JARS USED & NOT SUBMITTED: <u>NA</u>						TURNAROUND TIME											
IOL PROJECT # (if applicable): <u>NA</u>						☐ Alberta Tier 1 ☐ CDWG												Standard (5 days) ☒																	
MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: <u>417085-31872-21100</u>						☐ SEQG (SK) ☐ NoSC (SK)												Rush (3 days) ☐																	
						☒ CCME (incl. level) <u>FAL</u> ☐ Other												(2 days) ☐																	
																		(1 day) ☐																	
																		(same day) ☐																	
SEAL PRESENT ☒						SEAL PRESENT ☒						SEAL PRESENT ☒						Date Required																	
SEAL INTACT ☒						SEAL INTACT ☒						SEAL INTACT ☒						LAB USE ONLY																	
COOLING MEDIA PRESENT ☒						COOLING MEDIA PRESENT ☒						COOLING MEDIA PRESENT ☒						MAXXAM JOB #																	
RELINQUISHED BY: <u>Stacy Gibb</u>						DATE: <u>2021/09/17</u>						TIME (24 HR): <u>11:30</u>						RECEIVED BY: <u>Dawit Kibreab</u>						DATE: <u>2021/09/18</u>						TIME (24 HR): <u>14:50</u>					
1. <u>Stacy Gibb</u>						2. <u>Stacy Gibb</u>						3. <u>Stacy Gibb</u>						SAMPLES																	
2. <u>Stacy Gibb</u>						3. <u>Stacy Gibb</u>						LABELED BY: <u>DKR</u>						VERIFIED BY: <u>Stacy Gibb</u>																	
3. <u>Stacy Gibb</u>																																			

DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: <u>Advisian</u>	Sampling Date: <u>17-Sep-21</u>
Location: <u>Norman Wells</u>	Laboratory : <u>Bureau Veritas</u>
Consultant Project Number: <u>417085-31872.21100</u>	Sample Submission Number: <u>C170354</u>

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Instrument Surrogate Recovery	x			Matrix Duplicate RPD of F2 (C10-C16 Hydrocarbons) (104%) did not meet acceptance criteria (30%) for sample A360772. All other laboratory QC met acceptance criteria.
Extraction Surrogate Recovery	x			
Method Blank Concentration	x			
Matrix Duplicate RPD	x			
Matrix Spike Recovery	x			
Lab Control Sample Recovery	x			

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Field Blank Concentration			x	No field QC samples submitted.
Trip Blank Concentration			x	
Equipment Blank Concentration			x	
Field Duplicate RPD			x	

Has CoA been signed off (Yes/No)?:

Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?:

Were all samples analyzed within hold times (Yes/No)?:

All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?:

Is Chain of Custody completed and signed (Yes/No)?:

Were sample temperatures acceptable when they reached lab (Yes/No)?:

	<u>Yes</u>
	<u>Yes</u>
	<u>No</u>
	<u>n/a</u>
	<u>Yes</u>
	<u>Yes</u>

Was a Data Quality Overview (DQO) issued (Yes/No)?:

Date DQO was received: 27-Sep-21

Is data considered to be reliable (Yes/No)?:

Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): <u>Nandhini Durairaj</u>	Data Reviewed by (Signature): <u><i>D. Nandhini</i></u>
Date: <u>23-Dec-21</u>	

**Attention: Alex Haigh**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100
Your C.O.C. #: 299449

Report Date: 2021/09/27
Report #: R3077080
Version: 1 - Final

CERTIFICATE OF ANALYSIS**BV LABS JOB #: C170354****Received: 2021/09/20, 15:00**

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	2	AB SOP-00005	SM 23 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	2	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	2		Auto Calc
Cadmium - low level CCME - Dissolved	2		Auto Calc
Chloride/Sulphate by Auto Colourimetry	2	AB SOP-00020	SM23-4500-Cl/SO ₄ -E m
Conductivity @25C	2	AB SOP-00005	SM 23 2510 B m
Fluoride	2	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons in Water (F2; C10-C16) (1)	2	AB SOP-00037 AB SOP-00040	CCME PHC-CWS m
Hardness	2		Auto Calc
Mercury (Dissolved) by CV (2)	2	AB SOP-00084	BCMOE BCLM Oct2013 m
Elements by ICP - Dissolved (2)	2	AB SOP-00042	EPA 6010d R5 m
Elements by ICPMS - Dissolved (2)	2	AB SOP-00043	EPA 6020b R2 m
Ion Balance	2		Auto Calc
Nitrate and Nitrite	2		Auto Calc
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	2	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	2		Auto Calc
Phenols (4-AAP)	2	AB SOP-00088	EPA 9066 R0 m
Total Dissolved Solids (Filt. Residue)	2	AB SOP-00065	SM 23 2540 C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless



Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100
Your C.O.C. #: 299449

Attention: Alex Haigh

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Report Date: 2021/09/27
Report #: R3077080
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C170354

Received: 2021/09/20, 15:00

otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Silica gel clean up employed.

(2) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Mary (Xiaohong) Xu
Customer Solutions Representative
27 Sep 2021 16:35:49

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Namita Sahni, Customer Solutions Representative

Email: Namita.Sahni@bureauveritas.com

Phone# (604)639-2614

=====

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BUREAU
VERITASBV Labs Job #: C170354
Report Date: 2021/09/27

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

AT1 BTEX AND F1-F2 IN WATER (WATER)

BV Labs ID		AGJ755			AGJ755			AGJ756		
Sampling Date		2021/09/17 14:40			2021/09/17 14:40			2021/09/17 14:05		
COC Number		299449			299449			299449		
	UNITS	GIP11 09-1-4-R	RDL	QC Batch	GIP11 09-1-4-R Lab-Dup	RDL	QC Batch	GIQ8-10-2-4	RDL	QC Batch
Ext. Pet. Hydrocarbon										
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	0.10	A360772				0.26 (1)	0.10	A360772
Volatiles										
Benzene	mg/L	<0.00040	0.00040	A361868	<0.00040	0.00040	A361868	<0.00040	0.00040	A361868
Toluene	mg/L	<0.00040	0.00040	A361868	<0.00040	0.00040	A361868	<0.00040	0.00040	A361868
Ethylbenzene	mg/L	<0.00040	0.00040	A361868	<0.00040	0.00040	A361868	<0.00040	0.00040	A361868
m & p-Xylene	mg/L	<0.00080	0.00080	A361868	<0.00080	0.00080	A361868	<0.00080	0.00080	A361868
o-Xylene	mg/L	<0.00040	0.00040	A361868	<0.00040	0.00040	A361868	<0.00040	0.00040	A361868
Xylenes (Total)	mg/L	<0.00089	0.00089	A360046				<0.00089	0.00089	A360046
F1 (C6-C10) - BTEX	mg/L	<0.10	0.10	A360046				<0.10	0.10	A360046
F1 (C6-C10)	mg/L	<0.10	0.10	A361868	<0.10	0.10	A361868	<0.10	0.10	A361868
Extraction Surrogate Recovery (%)										
O-TERPHENYL (sur.)	%	108		A360772				109		A360772
Instrument Surrogate Recovery (%)										
1,4-Difluorobenzene (sur.)	%	105		A361868	100		A361868	105		A361868
4-Bromofluorobenzene (sur.)	%	95		A361868	101		A361868	97		A361868
D4-1,2-Dichloroethane (sur.)	%	102		A361868	95		A361868	101		A361868
RDL = Reportable Detection Limit										
Lab-Dup = Laboratory Initiated Duplicate										
(1) Duplicate exceeds acceptance criteria due to sample non homogeneity. Unable to reanalyze due to insufficient sample.										



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BV Labs Job #: C170354
Report Date: 2021/09/27

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

AT1 BTEX AND F1-F2 IN WATER (WATER)

BV Labs ID		AGJ756		
Sampling Date		2021/09/17 14:05		
COC Number		299449		
	UNITS	GIQ8-10-2-4 Lab-Dup	RDL	QC Batch
Ext. Pet. Hydrocarbon				
F2 (C10-C16 Hydrocarbons)	mg/L	0.82 (1)	0.10	A360772
Extraction Surrogate Recovery (%)				
O-TERPHENYL (sur.)	%	121		A360772
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate (1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.				

**RESULTS OF CHEMICAL ANALYSES OF WATER**

BV Labs ID		AGJ755			AGJ756		
Sampling Date		2021/09/17 14:40			2021/09/17 14:05		
COC Number		299449			299449		
	UNITS	GIP11 09-1-4-R	RDL	QC Batch	GIQ8-10-2-4	RDL	QC Batch
Calculated Parameters							
Hardness (CaCO ₃)	mg/L	260	0.50	A360020	1000	0.50	A360020
Ion Balance (% Difference)	%	0.050	N/A	A360021	2.8	N/A	A360190
Dissolved Nitrate (N)	mg/L	0.16	0.010	A360130	<0.050	0.050	A360130
Dissolved Nitrate (NO ₃)	mg/L	0.71	0.044	A360025	<0.22	0.22	A360025
Dissolved Nitrite (NO ₂)	mg/L	<0.033	0.033	A360025	<0.033	0.033	A360025
Elements							
Dissolved Cadmium (Cd)	mg/L	0.00013	0.000020	A359475	0.00040	0.000020	A359475
Misc. Inorganics							
Conductivity	uS/cm	510	2.0	A361568	1900	2.0	A361568
Total Dissolved Solids	mg/L	320	10	A362666	1500	10	A362666
Anions							
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	A361566	<1.0	1.0	A361566
Alkalinity (Total as CaCO ₃)	mg/L	230	1.0	A361566	550	1.0	A361566
Bicarbonate (HCO ₃)	mg/L	280	1.0	A361566	670	1.0	A361566
Carbonate (CO ₃)	mg/L	<1.0	1.0	A361566	<1.0	1.0	A361566
Dissolved Fluoride (F)	mg/L	0.078	0.050	A361569	0.092	0.050	A361569
Hydroxide (OH)	mg/L	<1.0	1.0	A361566	<1.0	1.0	A361566
Dissolved Chloride (Cl)	mg/L	5.4	1.0	A365457	21	1.0	A365457
Dissolved Sulphate (SO ₄)	mg/L	42	1.0	A365457	540	5.0	A365457
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A361604	<0.010	0.010	A361604
Dissolved Nitrate plus Nitrite (N)	mg/L	0.16	0.010	A361604	<0.050 (1)	0.050	A361604
Misc. Organics							
Phenols	mg/L	<0.0015	0.0015	A362684	0.0065	0.0015	A362684
RDL = Reportable Detection Limit							
N/A = Not Applicable							
(1) Detection limits raised due to matrix interference.							



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BV Labs Job #: C170354
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

MERCURY BY COLD VAPOR (WATER)

BV Labs ID		AGJ755	AGJ756		
Sampling Date		2021/09/17 14:40	2021/09/17 14:05		
COC Number		299449	299449		
	UNITS	GIP11 09-1-4-R	GIQ8-10-2-4	RDL	QC Batch
Elements					
Dissolved Mercury (Hg)	ug/L	<0.0019	<0.0019	0.0019	A364576
RDL = Reportable Detection Limit					

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Advisian

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Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGJ755	AGJ756		
Sampling Date		2021/09/17 14:40	2021/09/17 14:05		
COC Number		299449	299449		
	UNITS	GIP11 09-1-4-R	GIQ8-10-2-4	RDL	QC Batch
Elements					
Dissolved Aluminum (Al)	mg/L	0.044	0.021	0.0030	A362516
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	0.00060	A362516
Dissolved Arsenic (As)	mg/L	0.00069	0.0036	0.00020	A362516
Dissolved Barium (Ba)	mg/L	0.094	0.15	0.010	A361985
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010	A362516
Dissolved Boron (B)	mg/L	0.025	0.029	0.020	A361985
Dissolved Calcium (Ca)	mg/L	80	290	0.30	A361985
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0010	A362516
Dissolved Cobalt (Co)	mg/L	0.0016	0.012	0.00030	A362516
Dissolved Copper (Cu)	mg/L	0.0021	0.0038	0.00020	A362516
Dissolved Iron (Fe)	mg/L	0.28	5.4	0.060	A361985
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	0.00020	A362516
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	0.020	A361985
Dissolved Magnesium (Mg)	mg/L	16	68	0.20	A361985
Dissolved Manganese (Mn)	mg/L	0.65	4.0	0.0040	A361985
Dissolved Molybdenum (Mo)	mg/L	0.0016	0.00073	0.00020	A362516
Dissolved Nickel (Ni)	mg/L	0.0051	0.020	0.00050	A362516
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	0.10	A361985
Dissolved Potassium (K)	mg/L	2.5	3.0	0.30	A361985
Dissolved Selenium (Se)	mg/L	<0.00020	0.00069	0.00020	A362516
Dissolved Silicon (Si)	mg/L	3.3	5.0	0.10	A361985
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010	A362516
Dissolved Sodium (Na)	mg/L	6.6	27	0.50	A361985
Dissolved Strontium (Sr)	mg/L	0.38	1.3	0.020	A361985
Dissolved Sulphur (S)	mg/L	12	160	0.20	A361985
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020	A362516
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	0.0010	A362516
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	0.0010	A362516
Dissolved Uranium (U)	mg/L	0.0017	0.0077	0.00010	A362516
Dissolved Vanadium (V)	mg/L	0.0011	<0.0010	0.0010	A362516
Dissolved Zinc (Zn)	mg/L	0.0083	0.017	0.0030	A362516
RDL = Reportable Detection Limit					



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BV Labs Job #: C170354
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Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AGJ755
Sample ID: GIP11 09-1-4-R
Matrix: Water

Collected: 2021/09/17
Relinquished: 2021/09/18
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A361566	N/A	2021/09/23	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A361868	N/A	2021/09/24	Darrus Ong
F1-BTEX	CALC/MS	A360046	N/A	2021/09/25	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A359475	N/A	2021/09/24	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A365457	N/A	2021/09/25	Bradley Freake
Conductivity @25C	COND	A361568	N/A	2021/09/23	Ilonka Kovac
Fluoride	AT	A361569	N/A	2021/09/23	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A360772	2021/09/23	2021/09/26	Mosharraf Hossain
Hardness	CALC	A360020	N/A	2021/09/23	Automated Statchk
Mercury (Dissolved) by CV	CV	A364576	2021/09/24	2021/09/27	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A361985	N/A	2021/09/22	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A362516	N/A	2021/09/24	Lesley Quan
Ion Balance	CALC	A360021	N/A	2021/09/25	Automated Statchk
Nitrate and Nitrite	CALC	A360025	N/A	2021/09/23	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A361604	N/A	2021/09/22	Shanna McKort
Nitrate (as N)	CALC	A360130	2021/09/23	2021/09/23	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A362684	N/A	2021/09/23	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A362666	2021/09/23	2021/09/23	Amy Phan

BV Labs ID: AGJ755 Dup
Sample ID: GIP11 09-1-4-R
Matrix: Water

Collected: 2021/09/17
Relinquished: 2021/09/18
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A361868	N/A	2021/09/24	Darrus Ong

BV Labs ID: AGJ756
Sample ID: GIQ8-10-2-4
Matrix: Water

Collected: 2021/09/17
Relinquished: 2021/09/18
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A361566	N/A	2021/09/23	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A361868	N/A	2021/09/24	Darrus Ong
F1-BTEX	CALC/MS	A360046	N/A	2021/09/25	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A359475	N/A	2021/09/24	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A365457	N/A	2021/09/24	Bradley Freake
Conductivity @25C	COND	A361568	N/A	2021/09/23	Ilonka Kovac
Fluoride	AT	A361569	N/A	2021/09/23	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A360772	2021/09/23	2021/09/26	Mosharraf Hossain
Hardness	CALC	A360020	N/A	2021/09/23	Automated Statchk
Mercury (Dissolved) by CV	CV	A364576	2021/09/24	2021/09/27	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A361985	N/A	2021/09/22	Mohammad Pousti
Elements by ICPMS - Dissolved	ICPM	A362516	N/A	2021/09/24	Lesley Quan
Ion Balance	CALC	A360190	N/A	2021/09/25	Automated Statchk



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BV Labs Job #: C170354
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Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

TEST SUMMARY

BV Labs ID: AGJ756
Sample ID: GIQ8-10-2-4
Matrix: Water

Collected: 2021/09/17
Relinquished: 2021/09/18
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate and Nitrite	CALC	A360025	N/A	2021/09/23	Automated Statchk
NO2 (N); NO2 (N) + NO3 (N) in Water	AC/COL	A361604	N/A	2021/09/22	Shanna McKort
Nitrate (as N)	CALC	A360130	2021/09/23	2021/09/23	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A362684	N/A	2021/09/23	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A362666	2021/09/23	2021/09/23	Amy Phan

BV Labs ID: AGJ756 Dup
Sample ID: GIQ8-10-2-4
Matrix: Water

Collected: 2021/09/17
Relinquished: 2021/09/18
Received: 2021/09/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A360772	2021/09/23	2021/09/26	Mosharraf Hossain

**GENERAL COMMENTS**

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	3.3°C
Package 2	6.0°C
Package 3	5.0°C

Sample AGJ755 [GIP11 09-1-4-R] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Sample AGJ756 [GIQ8-10-2-4] : Sample was analyzed past method specified hold time for NO₂ (N); NO₂ (N) + NO₃ (N) in Water. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised.

Results relate only to the items tested.

DATA QUALITY OVERVIEW

Lab ID	Client Sample ID	Matrix	Test Code	Analysis Type	Parameters	Deviation	Root Cause	Potential Impact
AGJ755	GIP11 09-1-4-R	Water	NO23AC-W	NUTS	Sample	#10 Past Hold Time	#4 Re-Analysis Required	This may increase the uncertainty associated with these results.
AGJ756	GIQ8-10-2-4	Water	F2FIDE-W	EPH	F2 (C10-C16 Hydrocarbons)	#6 Duplicate RPD Above Control Limit	#6 Non-Homogeneous #14 No Repeat-Insuff. Sample	This may increase the uncertainty associated with these results.
AGJ756	GIQ8-10-2-4	Water	NO23AC-W	NUTS	Sample	#10 Past Hold Time	#4 Re-Analysis Required	This may increase the uncertainty associated with these results.



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BV Labs Job #: C170354
Report Date: 2021/09/27

Advisian
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Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A360772	MHF	Method Blank	O-TERPHENYL (sur.)	2021/09/26		122	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/26	<0.10		mg/L	
A361566	IKO	Method Blank	Alkalinity (Total as CaCO3)	2021/09/22	<1.0		mg/L	
			Alkalinity (PP as CaCO3)	2021/09/22	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/09/22	<1.0		mg/L	
			Carbonate (CO3)	2021/09/22	<1.0		mg/L	
			Hydroxide (OH)	2021/09/22	<1.0		mg/L	
A361568	IKO	Method Blank	Conductivity	2021/09/22	<2.0		uS/cm	
A361569	IKO	Method Blank	Dissolved Fluoride (F)	2021/09/23	<0.050		mg/L	
A361604	SKM	Method Blank	Dissolved Nitrite (N)	2021/09/22	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/22	<0.010		mg/L	
A361868	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2021/09/24		103	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/24		94	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/24		104	%	50 - 140
			Benzene	2021/09/24	<0.00040		mg/L	
			Toluene	2021/09/24	<0.00040		mg/L	
			Ethylbenzene	2021/09/24	<0.00040		mg/L	
			m & p-Xylene	2021/09/24	<0.00080		mg/L	
			o-Xylene	2021/09/24	<0.00040		mg/L	
			F1 (C6-C10)	2021/09/24	<0.10		mg/L	
A361985	MPU	Method Blank	Dissolved Iron (Fe)	2021/09/22	<0.060		mg/L	
			Dissolved Lithium (Li)	2021/09/22	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2021/09/22	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/09/22	<0.0040		mg/L	
			Dissolved Potassium (K)	2021/09/22	<0.30		mg/L	
			Dissolved Sodium (Na)	2021/09/22	<0.50		mg/L	
			Dissolved Strontium (Sr)	2021/09/22	<0.020		mg/L	
			Dissolved Sulphur (S)	2021/09/22	<0.20		mg/L	
			Dissolved Phosphorus (P)	2021/09/22	<0.10		mg/L	
			Dissolved Barium (Ba)	2021/09/22	<0.010		mg/L	
			Dissolved Silicon (Si)	2021/09/22	<0.10		mg/L	
			Dissolved Boron (B)	2021/09/22	<0.020		mg/L	
			Dissolved Calcium (Ca)	2021/09/22	<0.30		mg/L	
A362516	LQ1	Method Blank	Dissolved Aluminum (Al)	2021/09/24	<0.0030		mg/L	
			Dissolved Chromium (Cr)	2021/09/24	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2021/09/24	<0.00030		mg/L	
			Dissolved Copper (Cu)	2021/09/24	<0.00020		mg/L	
			Dissolved Lead (Pb)	2021/09/24	<0.00020		mg/L	
			Dissolved Antimony (Sb)	2021/09/24	<0.00060		mg/L	
			Dissolved Molybdenum (Mo)	2021/09/24	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2021/09/24	<0.00050		mg/L	
			Dissolved Selenium (Se)	2021/09/24	<0.00020		mg/L	
			Dissolved Silver (Ag)	2021/09/24	<0.00010		mg/L	
			Dissolved Arsenic (As)	2021/09/24	<0.00020		mg/L	
			Dissolved Thallium (Tl)	2021/09/24	<0.00020		mg/L	
			Dissolved Tin (Sn)	2021/09/24	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2021/09/24	<0.0010		mg/L	
			Dissolved Uranium (U)	2021/09/24	<0.00010		mg/L	
			Dissolved Vanadium (V)	2021/09/24	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2021/09/24	<0.0030		mg/L	
			Dissolved Beryllium (Be)	2021/09/24	<0.0010		mg/L	
A362666	AP1	Method Blank	Total Dissolved Solids	2021/09/23	<10		mg/L	

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Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A362684	TMU	Method Blank	Phenols	2021/09/23	<0.0015		mg/L	
A364576	RK3	Method Blank	Dissolved Mercury (Hg)	2021/09/24	<0.0019		ug/L	
A365457	BFE	Method Blank	Dissolved Chloride (Cl)	2021/09/25	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/09/25	<1.0		mg/L	
A361868	DO1	RPD [AGJ755-06]	Benzene	2021/09/24	NC		%	30
			Toluene	2021/09/24	NC		%	30
			Ethylbenzene	2021/09/24	NC		%	30
			m & p-Xylene	2021/09/24	NC		%	30
			o-Xylene	2021/09/24	NC		%	30
			F1 (C6-C10)	2021/09/24	NC		%	30
A360772	MHF	RPD [AGJ756-05]	F2 (C10-C16 Hydrocarbons)	2021/09/26	104 (1)		%	30
A361868	DO1	Matrix Spike [AGJ756-06]	1,4-Difluorobenzene (sur.)	2021/09/24		100	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/24		104	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/24		104	%	50 - 140
			Benzene	2021/09/24		102	%	50 - 140
			Toluene	2021/09/24		100	%	50 - 140
			Ethylbenzene	2021/09/24		101	%	50 - 140
			m & p-Xylene	2021/09/24		100	%	50 - 140
			o-Xylene	2021/09/24		99	%	50 - 140
			F1 (C6-C10)	2021/09/24		85	%	60 - 140
A360772	MHF	LCS	O-TERPHENYL (sur.)	2021/09/26		111	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/26		111	%	60 - 140
A361566	IKO	LCS	Alkalinity (Total as CaCO3)	2021/09/22		99	%	80 - 120
A361568	IKO	LCS	Conductivity	2021/09/22		102	%	90 - 110
A361569	IKO	LCS	Dissolved Fluoride (F)	2021/09/22		105	%	80 - 120
A361604	SKM	LCS	Dissolved Nitrite (N)	2021/09/22		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/22		104	%	80 - 120
A361868	DO1	LCS	1,4-Difluorobenzene (sur.)	2021/09/24		104	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/24		103	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/24		114	%	50 - 140
			Benzene	2021/09/24		105	%	60 - 130
			Toluene	2021/09/24		102	%	60 - 130
			Ethylbenzene	2021/09/24		105	%	60 - 130
			m & p-Xylene	2021/09/24		103	%	60 - 130
			o-Xylene	2021/09/24		101	%	60 - 130
			F1 (C6-C10)	2021/09/24		98	%	60 - 140
A361985	MPU	LCS	Dissolved Iron (Fe)	2021/09/22		112	%	80 - 120
			Dissolved Lithium (Li)	2021/09/22		102	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/22		104	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/22		111	%	80 - 120
			Dissolved Potassium (K)	2021/09/22		103	%	80 - 120
			Dissolved Sodium (Na)	2021/09/22		102	%	80 - 120
			Dissolved Strontium (Sr)	2021/09/22		98	%	80 - 120
			Dissolved Sulphur (S)	2021/09/22		101	%	80 - 120
			Dissolved Phosphorus (P)	2021/09/22		102	%	80 - 120
			Dissolved Barium (Ba)	2021/09/22		99	%	80 - 120
			Dissolved Silicon (Si)	2021/09/22		101	%	80 - 120
			Dissolved Boron (B)	2021/09/22		107	%	80 - 120
			Dissolved Calcium (Ca)	2021/09/22		100	%	80 - 120
A362516	LQ1	LCS	Dissolved Aluminum (Al)	2021/09/24		116	%	80 - 120
			Dissolved Chromium (Cr)	2021/09/24		111	%	80 - 120
			Dissolved Cobalt (Co)	2021/09/24		109	%	80 - 120

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Report Date: 2021/09/27

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: Norman Wells, NT

Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Copper (Cu)	2021/09/24		111	%	80 - 120
			Dissolved Lead (Pb)	2021/09/24		110	%	80 - 120
			Dissolved Antimony (Sb)	2021/09/24		120	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/09/24		111	%	80 - 120
			Dissolved Nickel (Ni)	2021/09/24		109	%	80 - 120
			Dissolved Selenium (Se)	2021/09/24		106	%	80 - 120
			Dissolved Silver (Ag)	2021/09/24		109	%	80 - 120
			Dissolved Arsenic (As)	2021/09/24		107	%	80 - 120
			Dissolved Thallium (Tl)	2021/09/24		109	%	80 - 120
			Dissolved Tin (Sn)	2021/09/24		112	%	80 - 120
			Dissolved Titanium (Ti)	2021/09/24		109	%	80 - 120
			Dissolved Uranium (U)	2021/09/24		110	%	80 - 120
			Dissolved Vanadium (V)	2021/09/24		111	%	80 - 120
			Dissolved Zinc (Zn)	2021/09/24		106	%	80 - 120
			Dissolved Beryllium (Be)	2021/09/24		113	%	80 - 120
A362666	AP1	LCS	Total Dissolved Solids	2021/09/23		101	%	80 - 120
A362684	TMU	LCS	Phenols	2021/09/23		98	%	80 - 120
A364576	RK3	LCS	Dissolved Mercury (Hg)	2021/09/24		101	%	80 - 120
A365457	BFE	LCS	Dissolved Chloride (Cl)	2021/09/24		108	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/24		100	%	80 - 120
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement. Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference. LCS: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy. Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination. Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency. NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference $\leq 2 \times \text{RDL}$). (1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.								



BUREAU
VERITAS

BV Labs Job #: C170354
Report Date: 2021/09/27

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: Norman Wells, NT
Project #: 417085-31872.21100

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Gita Pokhrel, Laboratory Supervisor

Janet Gao, B.Sc., QP, Supervisor, Organics

Maria Magdalena Florescu, Ph.D., P.Chem., QP, Inorganics Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

INVOICE INFORMATION				REPORT INFORMATION				ANALYSIS REQUESTED																																								
Company Name: ☒ Imperial Oil ☐ ExxonMobil				Company Name: <u>Worley</u>																																												
Contact Name: <u>Alex Haigh</u>				Contact Name: <u>Alex Haigh</u>																																												
Address: <u>150, 205 Quarry Park Blvd Calgary AB T2C 3E7</u>				Address: <u>150, 205 Quarry Park Blvd. Calgary, AB T2C 3E7</u>																																												
Email: <u>alex.haigh@advisian.com</u>				Email: <u>alex.haigh@advisian.com</u>																																												
Ph: <u>587-897-6249</u>				Ph: <u>587-897-6249</u>																																												
Sampler Name (Print): <u>Stacy Gibb/Douglas Harey</u>				Consultant Project #: <u>417085-31872-21100</u>																																												
FIELD SAMPLE ID	MATRIX					# CONTAINERS	SAMPLING		FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	VOC	PAH	PHCs (FRACTIONS 1-2 PLUS BTEX)	PHCs (FRACTIONS 1-4 PLUS BTEX)	PHCs (FRACTIONS 2-4)	PHCs (FRACTION 1 PLUS BTEX)	GRAIN SIZE (75 MICRON)	TEXTURE (% SAND, SILT, CLAY)	PARTICLE SIZE DISTRIBUTION WITH GRAPH	REGULATED METALS	TOT	DIS	MERCURY	TOTAL	DISSOLVED	SALINITY SOIL	FERTILIZER SOIL	FERTILIZER WATER	NUTRIENTS SOIL	ROUTINE POTABILITY	pH	EC	ALKALINITY	BASIC CLASS II LANDFILL PKG	Total Phenols	Fluoride												
	GROUND WATER	SURFACE WATER	SOIL	OTHER	DATE (YYYY/MM/DD)		TIME (24 HR)																																									
1 <u>GIP11 09-1-4-R</u>	☒					9	<u>2021/09/17</u>	<u>14:40</u>	☒				☒							☒	☒																											
2 <u>G1Q8-10-2-4</u>	☒					9	<u>2021/09/17</u>	<u>14:05</u>	☒				☒							☒	☒																											
3																																																
4																																																
5																																																
6																																																
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9																																																
10																																																
IOL SITE LOCATION <u>Norman Wells, NT</u>							REGULATORY CRITERIA / DETECTION LIMITS:							SPECIAL INSTRUCTIONS <u>Email: Canada.Chemistry@worley.com</u> <u>calocalor.data@worley.com</u>							# JARS USED & NOT SUBMITTED Enter N/A for Water		TURNAROUND TIME																									
IOL PROJECT # (if applicable) <u>N/A</u>							☐ Alberta Tier 1 ☐ CDWG																Standard (5 days) ☒																									
MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM <u>417085-31872-21100</u>							☐ SEQG (SK) ☐ NoSC (SK)																Rush (3 days) ☐																									
							☒ CCME (incl. level) <u>FAL</u>																(2 days) ☐																									
																							(1 day) ☐																									
																							(same day) ☐																									
																							Date Required																									
SEAL PRESENT							SEAL PRESENT							SEAL PRESENT									LAB USE ONLY																									
SEAL INTACT							SEAL INTACT							SEAL INTACT									MAXXAM JOB #																									
COOLING MEDIA PRESENT							COOLING MEDIA PRESENT							COOLING MEDIA PRESENT									C170354																									
RELINQUISHED BY:							DATE:							TIME (24 HR)							RECEIVED BY:							DATE:							TIME (24 HR)													
1. <u>[Signature]</u>							<u>2021/09/18</u>							<u>12:30</u>							1. <u>[Signature]</u>							<u>2021/09/20</u>							<u>15:00</u>													
2.																					2.																											
3.																												3.																				



ADDITIONAL COOLER TEMPERATURE RECORD

CHAIN-OF-CUSTODY RECORD

CHAIN OF CUSTODY #	
Page 1 of 1	299449
Page ___ of ___	
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Page ___ of ___	

COOLER OBSERVATIONS:				MAXXAM JOB#: C170354			
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☒	☐	TEMP	3	4	3	
INTACT	☒	☐					
ICE PRESENT	☒	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☒	☐	TEMP	5	7	6	
INTACT	☒	☐					
ICE PRESENT	☒	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☒	☐	TEMP	4	6	5	
INTACT	☒	☐					
ICE PRESENT	☒	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
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CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
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PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
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CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
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CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
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ICE PRESENT	☐	☐					
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PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					
CUSTODY SEAL	YES	NO	COOLER ID				
PRESENT	☐	☐	TEMP				
INTACT	☐	☐					
ICE PRESENT	☐	☐					

RECEIVED BY (SIGN & PRINT)	DATE (YYYY/MM/DD)	TIME (HH:MM)
Yifei Yang	2021/09/20	15:00

DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 18-Sep-21

Location: Norman Wells

Laboratory : Bureau Veritas

Consultant Project Number: 417085-31872.211C

Sample Submission Number: C171009

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Instrument Surrogate Recovery	x			All laboratory QC met acceptance criteria.
Extraction Surrogate Recovery	x			
Method Blank Concentration	x			
Matrix Duplicate RPD	x			
Matrix Spike Recovery	x			
Lab Control Sample Recovery	x			

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Field Blank Concentration			x	No field QC samples submitted.
Trip Blank Concentration			x	
Equipment Blank Concentration			x	
Field Duplicate RPD			x	

Has CoA been signed off (Yes/No)?:

Yes

Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?:

Yes

Were all samples analyzed within hold times (Yes/No)?:

Yes

All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?:

n/a

Is Chain of Custody completed and signed (Yes/No)?:

Yes

Were sample temperatures acceptable when they reached lab (Yes/No)?:

Yes

Was a Data Quality Overview (DQO) issued (Yes/No)?:

No

Date DQO was received: _____

Is data considered to be reliable (Yes/No)?:

Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Alice Liu

Date: 14-Mar-22

Data Reviewed by (Signature): Alice Liu

**Attention: Alex Haigh**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Task Order#: 417085-31872.21100
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 417085-31872.21100
Your C.O.C. #: 299448

Report Date: 2021/11/12
Report #: R3098593
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C171009

Received: 2021/09/22, 15:30

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	3	AB SOP-00005	SM 23 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	3	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	3		Auto Calc
Cadmium - low level CCME - Dissolved	3		Auto Calc
Chloride/Sulphate by Auto Colourimetry	3	AB SOP-00020	SM23-4500-Cl/SO ₄ -E m
Conductivity @25C	3	AB SOP-00005	SM 23 2510 B m
Fluoride	3	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons in Water (F2; C10-C16) (1)	3	AB SOP-00037 AB SOP-00040	CCME PHC-CWS m
Hardness	3		Auto Calc
Mercury (Dissolved) by CV (2)	3	AB SOP-00084	BCMOE BCLM Oct2013 m
Elements by ICP - Dissolved (2)	3	AB SOP-00042	EPA 6010d R5 m
Elements by ICPMS - Dissolved (2)	3	AB SOP-00043	EPA 6020b R2 m
Ion Balance	3		Auto Calc
Nitrate and Nitrite	3		Auto Calc
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	3	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	3		Auto Calc
Phenols (4-AAP)	3	AB SOP-00088	EPA 9066 R0 m
Total Dissolved Solids (Filt. Residue)	3	AB SOP-00065	SM 23 2540 C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless



Task Order#: 417085-31872.21100
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 417085-31872.21100
Your C.O.C. #: 299448

Attention: Alex Haigh

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

Report Date: 2021/11/12
Report #: R3098593
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C171009

Received: 2021/09/22, 15:30

otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Silica gel clean up employed.

(2) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Namita Sahni
Customer Solutions Representative
12 Nov 2021 16:15:54

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Namita Sahni, Customer Solutions Representative

Email: Namita.Sahni@bureauveritas.com

Phone# (604)639-2614

=====

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VERITAS

Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

AT1 BTEX AND F1-F2 IN WATER (WATER)

Bureau Veritas ID		AGO042	AGO044	AGO045		
Sampling Date		2021/09/18 13:50	2021/09/18 14:15	2021/09/18 14:35		
COC Number		299448	299448	299448		
	UNITS	BIS 97-1-3	BI-13-1-4	BI-13-3-4.5	RDL	QC Batch
Ext. Pet. Hydrocarbon						
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	0.10	A364417
Volatiles						
Benzene	mg/L	<0.00040	<0.00040	<0.00040	0.00040	A363350
Toluene	mg/L	<0.00040	<0.00040	<0.00040	0.00040	A363350
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	0.00040	A363350
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	0.00080	A363350
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	0.00040	A363350
Xylenes (Total)	mg/L	<0.00089	<0.00089	<0.00089	0.00089	A362246
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	0.10	A362246
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	0.10	A363350
Extraction						
Surrogate Recovery (%)						
O-TERPHENYL (sur.)	%	100	102	114		A364417
Instrument						
Surrogate Recovery (%)						
1,4-Difluorobenzene (sur.)	%	103	101	106		A363350
4-Bromofluorobenzene (sur.)	%	97	96	95		A363350
D4-1,2-Dichloroethane (sur.)	%	108	107	107		A363350
RDL = Reportable Detection Limit						



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VERITAS

Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

RESULTS OF CHEMICAL ANALYSES OF WATER

Bureau Veritas ID		AGO042		AGO044		AGO045		
Sampling Date		2021/09/18 13:50		2021/09/18 14:15		2021/09/18 14:35		
COC Number		299448		299448		299448		
	UNITS	BIS 97-1-3	RDL	BI-13-1-4	RDL	BI-13-3-4.5	RDL	QC Batch
Calculated Parameters								
Hardness (CaCO ₃)	mg/L	1000	0.50	910	0.50	1300	0.50	A362387
Ion Balance (% Difference)	%	2.2	N/A	7.4	N/A	4.1	N/A	A362390
Dissolved Nitrate (N)	mg/L	0.012	0.010	0.059	0.050	<0.010	0.010	A362162
Dissolved Nitrate (NO ₃)	mg/L	0.054	0.044	0.26	0.22	<0.044	0.044	A362607
Dissolved Nitrite (NO ₂)	mg/L	<0.033	0.033	<0.033	0.033	<0.033	0.033	A362607
Elements								
Dissolved Cadmium (Cd)	mg/L	0.000040	0.000020	<0.000020	0.000020	0.000068	0.000020	A362126
Misc. Inorganics								
Conductivity	uS/cm	1800	2.0	1500	2.0	2000	2.0	A364509
Total Dissolved Solids	mg/L	1200	10	890	10	1700	10	A364078
Anions								
Alkalinity (PP as CaCO ₃)	mg/L	<1.0	1.0	<1.0	1.0	<1.0	1.0	A364502
Alkalinity (Total as CaCO ₃)	mg/L	870	1.0	780	1.0	390	1.0	A364502
Bicarbonate (HCO ₃)	mg/L	1100	1.0	960	1.0	480	1.0	A364502
Carbonate (CO ₃)	mg/L	<1.0	1.0	<1.0	1.0	<1.0	1.0	A364502
Dissolved Fluoride (F)	mg/L	0.25	0.050	0.28	0.050	0.30	0.050	A364510
Hydroxide (OH)	mg/L	<1.0	1.0	<1.0	1.0	<1.0	1.0	A364502
Dissolved Chloride (Cl)	mg/L	23	1.0	11	1.0	5.5	1.0	A368265
Dissolved Sulphate (SO ₄)	mg/L	180	2.0	79	1.0	800	5.0	A368265
Nutrients								
Dissolved Nitrite (N)	mg/L	<0.010	0.010	<0.010	0.010	<0.010	0.010	A363993
Dissolved Nitrate plus Nitrite (N)	mg/L	0.012	0.010	0.059 (1)	0.050	<0.010	0.010	A363993
Misc. Organics								
Phenols	mg/L	<0.0015	0.0015	<0.0015	0.0015	<0.0015	0.0015	A364128
RDL = Reportable Detection Limit								
N/A = Not Applicable								
(1) Detection limits raised due to matrix interference.								



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Bureau Veritas Job #: C171009
Report Date: 2021/11/12

Advisian
Task Order#: 417085-31872.21100
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 417085-31872.21100

RESULTS OF CHEMICAL ANALYSES OF WATER

Bureau Veritas ID		AGO045		
Sampling Date		2021/09/18 14:35		
COC Number		299448		
	UNITS	BI-13-3-4.5 Lab-Dup	RDL	QC Batch
Misc. Organics				
Phenols	mg/L	<0.0015	0.0015	A364128
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate				



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Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

MERCURY BY COLD VAPOR (WATER)

Bureau Veritas ID		AGO042	AGO044	AGO045		
Sampling Date		2021/09/18 13:50	2021/09/18 14:15	2021/09/18 14:35		
COC Number		299448	299448	299448		
	UNITS	BIS 97-1-3	BI-13-1-4	BI-13-3-4.5	RDL	QC Batch
Elements						
Dissolved Mercury (Hg)	ug/L	<0.0019	<0.0019	<0.0019	0.0019	A368251
RDL = Reportable Detection Limit						



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Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGO042	AGO044	AGO045			AGO045		
Sampling Date		2021/09/18 13:50	2021/09/18 14:15	2021/09/18 14:35			2021/09/18 14:35		
COC Number		299448	299448	299448			299448		
	UNITS	BIS 97-1-3	BI-13-1-4	BI-13-3-4.5	RDL	QC Batch	BI-13-3-4.5 Lab-Dup	RDL	QC Batch
Elements									
Dissolved Aluminum (Al)	mg/L	0.011	0.0070	<0.0030	0.0030	A364659	<0.0030	0.0030	A364659
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	0.00060	A364659	<0.00060	0.00060	A364659
Dissolved Arsenic (As)	mg/L	0.0010	0.013	0.00092	0.00020	A364659	0.0011	0.00020	A364659
Dissolved Barium (Ba)	mg/L	0.062	0.087	0.045	0.010	A364772			
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A364659	<0.0010	0.0010	A364659
Dissolved Boron (B)	mg/L	<0.020	0.023	0.024	0.020	A364772			
Dissolved Calcium (Ca)	mg/L	250	240	310	0.30	A364772			
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A364659	<0.0010	0.0010	A364659
Dissolved Cobalt (Co)	mg/L	0.0040	0.0061	0.0043	0.00030	A364659	0.0042	0.00030	A364659
Dissolved Copper (Cu)	mg/L	0.0048	0.0022	0.0045	0.00020	A364659	0.0046	0.00020	A364659
Dissolved Iron (Fe)	mg/L	3.2	42	1.2	0.060	A364772			
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	0.00020	A364659	<0.00020	0.00020	A364659
Dissolved Lithium (Li)	mg/L	0.020	0.024	0.024	0.020	A364772			
Dissolved Magnesium (Mg)	mg/L	92	79	130	0.20	A364772			
Dissolved Manganese (Mn)	mg/L	1.0	1.7	0.53	0.0040	A364772			
Dissolved Molybdenum (Mo)	mg/L	0.0046	0.0016	0.018	0.00020	A364659	0.018	0.00020	A364659
Dissolved Nickel (Ni)	mg/L	0.013	0.0093	0.037	0.00050	A364659	0.036	0.00050	A364659
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	0.10	A364772			
Dissolved Potassium (K)	mg/L	3.3	1.5	2.9	0.30	A364772			
Dissolved Selenium (Se)	mg/L	0.00041	0.00047	0.0012	0.00020	A364659	0.0012	0.00020	A364659
Dissolved Silicon (Si)	mg/L	4.9	6.1	5.5	0.10	A364772			
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A364659	<0.00010	0.00010	A364659
Dissolved Sodium (Na)	mg/L	17	14	12	0.50	A364772			
Dissolved Strontium (Sr)	mg/L	0.91	1.6	0.89	0.020	A364772			
Dissolved Sulphur (S)	mg/L	53	21	270	0.20	A364772			
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	0.00020	A364659	<0.00020	0.00020	A364659
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A364659	<0.0010	0.0010	A364659
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A364659	<0.0010	0.0010	A364659
Dissolved Uranium (U)	mg/L	0.0029	0.0015	0.0097	0.00010	A364659	0.0099	0.00010	A364659
Dissolved Vanadium (V)	mg/L	<0.0010	0.0017	<0.0010	0.0010	A364659	<0.0010	0.0010	A364659
RDL = Reportable Detection Limit									
Lab-Dup = Laboratory Initiated Duplicate									



BUREAU
VERITAS

Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGO042	AGO044	AGO045			AGO045		
Sampling Date		2021/09/18 13:50	2021/09/18 14:15	2021/09/18 14:35			2021/09/18 14:35		
COC Number		299448	299448	299448			299448		
	UNITS	BIS 97-1-3	BI-13-1-4	BI-13-3-4.5	RDL	QC Batch	BI-13-3-4.5 Lab-Dup	RDL	QC Batch
Dissolved Zinc (Zn)	mg/L	0.010	0.011	0.035	0.0030	A364659	0.034	0.0030	A364659
RDL = Reportable Detection Limit									
Lab-Dup = Laboratory Initiated Duplicate									



BUREAU
VERITAS

Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

TEST SUMMARY

Bureau Veritas ID: AGO042
Sample ID: BIS 97-1-3
Matrix: Water

Collected: 2021/09/18
Relinquished: 2021/09/20
Received: 2021/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A364502	N/A	2021/09/25	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A363350	N/A	2021/09/27	Darrus Ong
F1-BTEX	CALC/MS	A362246	N/A	2021/09/28	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A362126	N/A	2021/09/27	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A368265	N/A	2021/09/29	Bradley Freake
Conductivity @25C	COND	A364509	N/A	2021/09/25	Ilonka Kovac
Fluoride	AT	A364510	N/A	2021/09/25	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A364417	2021/09/24	2021/09/28	Seyedsajjad Hosseini
Hardness	CALC	A362387	N/A	2021/09/27	Automated Statchk
Mercury (Dissolved) by CV	CV	A368251	2021/09/28	2021/09/28	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A364772	N/A	2021/09/26	Mary Anne Dela Cruz
Elements by ICPMS - Dissolved	ICPM	A364659	N/A	2021/09/26	Kevin Huang
Ion Balance	CALC	A362390	N/A	2021/09/29	Automated Statchk
Nitrate and Nitrite	CALC	A362607	N/A	2021/09/24	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A363993	N/A	2021/09/23	Shanna McKort
Nitrate (as N)	CALC	A362162	2021/09/24	2021/09/24	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A364128	N/A	2021/09/24	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A364078	2021/09/24	2021/09/24	Amy Phan

Bureau Veritas ID: AGO044
Sample ID: BI-13-1-4
Matrix: Water

Collected: 2021/09/18
Relinquished: 2021/09/20
Received: 2021/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A364502	N/A	2021/09/25	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A363350	N/A	2021/09/27	Darrus Ong
F1-BTEX	CALC/MS	A362246	N/A	2021/09/28	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A362126	N/A	2021/09/27	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A368265	N/A	2021/09/29	Bradley Freake
Conductivity @25C	COND	A364509	N/A	2021/09/25	Ilonka Kovac
Fluoride	AT	A364510	N/A	2021/09/25	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A364417	2021/09/24	2021/09/28	Seyedsajjad Hosseini
Hardness	CALC	A362387	N/A	2021/09/27	Automated Statchk
Mercury (Dissolved) by CV	CV	A368251	2021/09/28	2021/09/28	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A364772	N/A	2021/09/26	Mary Anne Dela Cruz
Elements by ICPMS - Dissolved	ICPM	A364659	N/A	2021/09/26	Kevin Huang
Ion Balance	CALC	A362390	N/A	2021/09/29	Automated Statchk
Nitrate and Nitrite	CALC	A362607	N/A	2021/09/24	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A363993	N/A	2021/09/23	Shanna McKort
Nitrate (as N)	CALC	A362162	2021/09/24	2021/09/24	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A364128	N/A	2021/09/24	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A364078	2021/09/24	2021/09/24	Amy Phan



**BUREAU
VERITAS**

Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

TEST SUMMARY

Bureau Veritas ID: AGO045
Sample ID: BI-13-3-4.5
Matrix: Water

Collected: 2021/09/18
Relinquished: 2021/09/20
Received: 2021/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	AT/ALK	A364502	N/A	2021/09/25	Ilonka Kovac
BTEX/F1 in Water by HS GC/MS/FID	HSGC/MS	A363350	N/A	2021/09/27	Darrus Ong
F1-BTEX	CALC/MS	A362246	N/A	2021/09/28	Automated Statchk
Cadmium - low level CCME - Dissolved	CALC/MS	A362126	N/A	2021/09/27	Automated Statchk
Chloride/Sulphate by Auto Colourimetry	KONE	A368265	N/A	2021/09/29	Bradley Freake
Conductivity @25C	COND	A364509	N/A	2021/09/25	Ilonka Kovac
Fluoride	AT	A364510	N/A	2021/09/25	Ilonka Kovac
CCME Hydrocarbons in Water (F2; C10-C16)	GC/FID	A364417	2021/09/24	2021/09/28	Seyedsajjad Hosseini
Hardness	CALC	A362387	N/A	2021/09/27	Automated Statchk
Mercury (Dissolved) by CV	CV	A368251	2021/09/28	2021/09/28	Riazuddin Khan
Elements by ICP - Dissolved	ICPA	A364772	N/A	2021/09/26	Mary Anne Dela Cruz
Elements by ICPMS - Dissolved	ICPM	A364659	N/A	2021/09/26	Kevin Huang
Ion Balance	CALC	A362390	N/A	2021/09/29	Automated Statchk
Nitrate and Nitrite	CALC	A362607	N/A	2021/09/24	Automated Statchk
NO ₂ (N); NO ₂ (N) + NO ₃ (N) in Water	AC/COL	A363993	N/A	2021/09/23	Shanna McKort
Nitrate (as N)	CALC	A362162	2021/09/24	2021/09/24	Automated Statchk
Phenols (4-AAP)	TECH/4AAP	A364128	N/A	2021/09/24	Taylor Mullings
Total Dissolved Solids (Filt. Residue)	BAL	A364078	2021/09/24	2021/09/24	Amy Phan

Bureau Veritas ID: AGO045 Dup
Sample ID: BI-13-3-4.5
Matrix: Water

Collected: 2021/09/18
Relinquished: 2021/09/20
Received: 2021/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Elements by ICPMS - Dissolved	ICPM	A364659	N/A	2021/09/26	Kevin Huang
Phenols (4-AAP)	TECH/4AAP	A364128	N/A	2021/09/24	Taylor Mullings



GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C
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Revised report (V2) to include updated sample ID as requested on 11/12/2021

Sample AGO042 [BIS 97-1-3] : NO₂ (N); NO₂ (N) + NO₃ (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes.

Sample AGO044 [BI-13-1-4] : NO₂ (N); NO₂ (N) + NO₃ (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes.

Sample AGO045 [BI-13-3-4.5] : NO₂ (N); NO₂ (N) + NO₃ (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes.

Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A363350	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2021/09/27		102	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/27		97	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/27		106	%	50 - 140
			Benzene	2021/09/27	<0.00040		mg/L	
			Toluene	2021/09/27	<0.00040		mg/L	
			Ethylbenzene	2021/09/27	<0.00040		mg/L	
			m & p-Xylene	2021/09/27	<0.00080		mg/L	
			o-Xylene	2021/09/27	<0.00040		mg/L	
			F1 (C6-C10)	2021/09/27	<0.10		mg/L	
A363993	SKM	Method Blank	Dissolved Nitrite (N)	2021/09/23	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/23	<0.010		mg/L	
A364078	AP1	Method Blank	Total Dissolved Solids	2021/09/24	<10		mg/L	
A364128	TMU	Method Blank	Phenols	2021/09/24	<0.0015		mg/L	
A364417	SEH	Method Blank	O-TERPHENYL (sur.)	2021/09/27		109	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/27	<0.10		mg/L	
A364502	IKO	Method Blank	Alkalinity (Total as CaCO3)	2021/09/25	<1.0		mg/L	
			Alkalinity (PP as CaCO3)	2021/09/25	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/09/25	<1.0		mg/L	
			Carbonate (CO3)	2021/09/25	<1.0		mg/L	
			Hydroxide (OH)	2021/09/25	<1.0		mg/L	
A364509	IKO	Method Blank	Conductivity	2021/09/25	<2.0		uS/cm	
A364510	IKO	Method Blank	Dissolved Fluoride (F)	2021/09/25	<0.050		mg/L	
A364659	KH2	Method Blank	Dissolved Aluminum (Al)	2021/09/26	<0.0030		mg/L	
			Dissolved Chromium (Cr)	2021/09/26	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2021/09/26	<0.00030		mg/L	
			Dissolved Copper (Cu)	2021/09/26	<0.00020		mg/L	
			Dissolved Lead (Pb)	2021/09/26	<0.00020		mg/L	
			Dissolved Antimony (Sb)	2021/09/26	<0.00060		mg/L	
			Dissolved Molybdenum (Mo)	2021/09/26	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2021/09/26	<0.00050		mg/L	
			Dissolved Selenium (Se)	2021/09/26	<0.00020		mg/L	
			Dissolved Silver (Ag)	2021/09/26	<0.00010		mg/L	
			Dissolved Arsenic (As)	2021/09/26	<0.00020		mg/L	
			Dissolved Thallium (Tl)	2021/09/26	<0.00020		mg/L	
			Dissolved Tin (Sn)	2021/09/26	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2021/09/26	<0.0010		mg/L	
			Dissolved Uranium (U)	2021/09/26	<0.00010		mg/L	
			Dissolved Vanadium (V)	2021/09/26	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2021/09/26	<0.0030		mg/L	
			Dissolved Beryllium (Be)	2021/09/26	<0.0010		mg/L	
			Dissolved Iron (Fe)	2021/09/26	<0.060		mg/L	
			Dissolved Lithium (Li)	2021/09/26	<0.020		mg/L	
A364772	MAP	Method Blank	Dissolved Magnesium (Mg)	2021/09/26	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/09/26	<0.0040		mg/L	
			Dissolved Potassium (K)	2021/09/26	<0.30		mg/L	
			Dissolved Sodium (Na)	2021/09/26	<0.50		mg/L	
			Dissolved Strontium (Sr)	2021/09/26	<0.020		mg/L	
			Dissolved Sulphur (S)	2021/09/26	<0.20		mg/L	
			Dissolved Phosphorus (P)	2021/09/26	<0.10		mg/L	
			Dissolved Barium (Ba)	2021/09/26	<0.010		mg/L	
			Dissolved Silicon (Si)	2021/09/26	<0.10		mg/L	
			Dissolved Boron (B)	2021/09/26	<0.020		mg/L	



BUREAU
VERITAS

Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A368251	RK3	Method Blank	Dissolved Calcium (Ca)	2021/09/26	<0.30		mg/L	
A368265	BFE	Method Blank	Dissolved Mercury (Hg)	2021/09/28	<0.0019		ug/L	
			Dissolved Chloride (Cl)	2021/09/28	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/09/28	<1.0		mg/L	
A364128	TMU	RPD [AGO045-03]	Phenols	2021/09/24	NC		%	20
A364659	KH2	RPD [AGO045-04]	Dissolved Aluminum (Al)	2021/09/26	NC		%	20
			Dissolved Chromium (Cr)	2021/09/26	NC		%	20
			Dissolved Cobalt (Co)	2021/09/26	1.2		%	20
			Dissolved Copper (Cu)	2021/09/26	0.68		%	20
			Dissolved Lead (Pb)	2021/09/26	NC		%	20
			Dissolved Antimony (Sb)	2021/09/26	NC		%	20
			Dissolved Molybdenum (Mo)	2021/09/26	2.3		%	20
			Dissolved Nickel (Ni)	2021/09/26	2.9		%	20
			Dissolved Selenium (Se)	2021/09/26	0.24		%	20
			Dissolved Silver (Ag)	2021/09/26	NC		%	20
			Dissolved Arsenic (As)	2021/09/26	18		%	20
			Dissolved Thallium (Tl)	2021/09/26	NC		%	20
			Dissolved Tin (Sn)	2021/09/26	NC		%	20
			Dissolved Titanium (Ti)	2021/09/26	NC		%	20
			Dissolved Uranium (U)	2021/09/26	1.4		%	20
			Dissolved Vanadium (V)	2021/09/26	NC		%	20
			Dissolved Zinc (Zn)	2021/09/26	3.2		%	20
			Dissolved Beryllium (Be)	2021/09/26	NC		%	20
A364128	TMU	Matrix Spike [AGO045-03]	Phenols	2021/09/24		97	%	80 - 120
A364659	KH2	Matrix Spike [AGO045-04]	Dissolved Aluminum (Al)	2021/09/26		96	%	80 - 120
			Dissolved Chromium (Cr)	2021/09/26		97	%	80 - 120
			Dissolved Cobalt (Co)	2021/09/26		95	%	80 - 120
			Dissolved Copper (Cu)	2021/09/26		94	%	80 - 120
			Dissolved Lead (Pb)	2021/09/26		95	%	80 - 120
			Dissolved Antimony (Sb)	2021/09/26		108	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/09/26		109	%	80 - 120
			Dissolved Nickel (Ni)	2021/09/26		93	%	80 - 120
			Dissolved Selenium (Se)	2021/09/26		109	%	80 - 120
			Dissolved Silver (Ag)	2021/09/26		99	%	80 - 120
			Dissolved Arsenic (As)	2021/09/26		100	%	80 - 120
			Dissolved Thallium (Tl)	2021/09/26		98	%	80 - 120
			Dissolved Tin (Sn)	2021/09/26		107	%	80 - 120
			Dissolved Titanium (Ti)	2021/09/26		105	%	80 - 120
			Dissolved Uranium (U)	2021/09/26		95	%	80 - 120
			Dissolved Vanadium (V)	2021/09/26		102	%	80 - 120
			Dissolved Zinc (Zn)	2021/09/26		93	%	80 - 120
			Dissolved Beryllium (Be)	2021/09/26		95	%	80 - 120
A363350	DO1	LCS	1,4-Difluorobenzene (sur.)	2021/09/27		100	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/27		97	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/27		99	%	50 - 140
			Benzene	2021/09/27		101	%	60 - 130
			Toluene	2021/09/27		103	%	60 - 130
			Ethylbenzene	2021/09/27		105	%	60 - 130
			m & p-Xylene	2021/09/27		105	%	60 - 130
			o-Xylene	2021/09/27		105	%	60 - 130



BUREAU
VERITAS

Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A363993	SKM	LCS	F1 (C6-C10)	2021/09/27		104	%	60 - 140
			Dissolved Nitrite (N)	2021/09/23		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/23		106	%	80 - 120
A364078	AP1	LCS	Total Dissolved Solids	2021/09/24		96	%	80 - 120
A364128	TMU	LCS	Phenols	2021/09/24		98	%	80 - 120
A364417	SEH	LCS	O-TERPHENYL (sur.)	2021/09/27		113	%	60 - 140
A364502	IKO	LCS	F2 (C10-C16 Hydrocarbons)	2021/09/27		104	%	60 - 140
			Alkalinity (Total as CaCO ₃)	2021/09/25		98	%	80 - 120
			Conductivity	2021/09/25		104	%	90 - 110
			Dissolved Fluoride (F)	2021/09/25		106	%	80 - 120
			Dissolved Aluminum (Al)	2021/09/26		94	%	80 - 120
			Dissolved Chromium (Cr)	2021/09/26		102	%	80 - 120
			Dissolved Cobalt (Co)	2021/09/26		100	%	80 - 120
			Dissolved Copper (Cu)	2021/09/26		101	%	80 - 120
			Dissolved Lead (Pb)	2021/09/26		97	%	80 - 120
			Dissolved Antimony (Sb)	2021/09/26		106	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/09/26		106	%	80 - 120
			Dissolved Nickel (Ni)	2021/09/26		100	%	80 - 120
			Dissolved Selenium (Se)	2021/09/26		111	%	80 - 120
			Dissolved Silver (Ag)	2021/09/26		101	%	80 - 120
			Dissolved Arsenic (As)	2021/09/26		103	%	80 - 120
			Dissolved Thallium (Tl)	2021/09/26		97	%	80 - 120
			Dissolved Tin (Sn)	2021/09/26		107	%	80 - 120
			Dissolved Titanium (Ti)	2021/09/26		101	%	80 - 120
			Dissolved Uranium (U)	2021/09/26		95	%	80 - 120
			Dissolved Vanadium (V)	2021/09/26		104	%	80 - 120
			Dissolved Zinc (Zn)	2021/09/26		94	%	80 - 120
			Dissolved Beryllium (Be)	2021/09/26		92	%	80 - 120
A364772	MAP	LCS	Dissolved Iron (Fe)	2021/09/26		114	%	80 - 120
			Dissolved Lithium (Li)	2021/09/26		106	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/26		110	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/26		114	%	80 - 120
			Dissolved Potassium (K)	2021/09/26		108	%	80 - 120
			Dissolved Sodium (Na)	2021/09/26		105	%	80 - 120
			Dissolved Strontium (Sr)	2021/09/26		100	%	80 - 120
			Dissolved Sulphur (S)	2021/09/26		102	%	80 - 120
			Dissolved Phosphorus (P)	2021/09/26		101	%	80 - 120
			Dissolved Barium (Ba)	2021/09/26		102	%	80 - 120
			Dissolved Silicon (Si)	2021/09/26		107	%	80 - 120
			Dissolved Boron (B)	2021/09/26		106	%	80 - 120
			Dissolved Calcium (Ca)	2021/09/26		104	%	80 - 120
A368251	RK3	LCS	Dissolved Mercury (Hg)	2021/09/29		107	%	80 - 120
A368265	BFE	LCS	Dissolved Chloride (Cl)	2021/09/28		104	%	80 - 120



BUREAU
VERITAS

Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				Dissolved Sulphate (SO4)	2021/09/28		98	%	80 - 120
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.									
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.									
LCS: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.									
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.									
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.									
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).									



BUREAU
VERITAS

Bureau Veritas Job #: C171009

Report Date: 2021/11/12

Advisian

Task Order#: 417085-31872.21100

Site#: N/A

Site Location: NORMAN WELLS, NT

Project #: 417085-31872.21100

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Gita Pokhrel, Laboratory Supervisor

Janet Gao, B.Sc., QP, Supervisor, Organics

Sandy Yuan, M.Sc., QP, Scientific Specialist

Sze Yeung Fock, B.Sc., Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

INVOICE INFORMATION				REPORT INFORMATION				ANALYSIS REQUESTED																											
Company Name: ☒ Imperial Oil ☐ ExxonMobil				Company Name: <u>Worley</u>																															
Contact Name: <u>Alex Haigh</u>				Contact Name: <u>Alex Haigh</u>																															
Address: <u>150, 205 Quarry Park Blvd SE</u> <u>Calgary, AB T2C 3E7</u>				Address: <u>150, 205 Quarry Park Blvd SE</u> <u>Calgary, AB T2C 3E7</u>																															
Email: <u>alex.haigh@advisian.com</u>				Email: <u>alex.haigh@advisian.com</u>																															
Ph: <u>587 897 6249</u>				Ph: <u>587 897 6249</u>																															
Sampler Name (Print): <u>Stacy Gibb & Doug Haney</u>				Consultant Project #: <u>417085-31872-21100</u>																															
FIELD SAMPLE ID	MATRIX				# CONTAINERS	SAMPLING		FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	VOC	PAH	PHCs (FRACTIONS 1-2 PLUS BTEX)	PHCs (FRACTIONS 1-4 PLUS BTEX)	PHCs (FRACTIONS 2-4)	PHCs (FRACTION 1 PLUS BTEX)	GRAIN SIZE (75 MICRON)	TEXTURE (% SAND, SILT, CLAY)	PARTICLE SIZE DISTRIBUTION WITH GRAPH	REGULATED METALS	TOT	DIS	MERCURY	TOTAL	DISSOLVED	SALINITY SOIL	FERTILIZER SOIL	FERTILIZER WATER	NUTRIENTS SOIL	ROUTINE POTABILITY	pH	EC	ALKALINITY	BASIC CLASS II LANDFILL PKG	Total Phenols	Fluoride
	GROUND WATER	SURFACE WATER	SOIL	OTHER		DATE (YYYY/MM/DD)	TIME (24 HR)																												
1 <u>BIS 97-1-3</u>	☒				9	<u>2021/09/18</u>	<u>13:50</u>	☒				☒							☒	☒														☒	☒
2 <u>BI-13-1-4</u>	☒				9	<u>2021/09/18</u>	<u>14:15</u>	☒				☒							☒	☒													☒	☒	
3 <u>BI-13-3-4.5</u>						<u>2021/09/18</u>	<u>14:35</u>	☒				☒							☒	☒												☒	☒		
4																																			
5																																			
6																																			
7																																			
8																																			
9																																			
10																																			
IOL SITE LOCATION <u>Norman Wells, NT</u>				IOL PROJECT # (if applicable) <u>NA</u>				MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM <u>417085-31872-21100</u>				REGULATORY CRITERIA / DETECTION LIMITS: ☐ Alberta Tier 1 ☐ CDWG ☐ SEQG (SK) ☐ NoSC (SK) ☒ CCME <u>FAL</u> (incl. level) ☐ Other _____				SPECIAL INSTRUCTIONS <u>email canada.chemistry@worley.com</u> <u>ccal.ior.data@ckc.ca</u>				# JARS USED & NOT SUBMITTED Enter N/A for Water <u>NA</u>				TURNAROUND TIME Standard (5 days) ☒ Rush (3 days) ☐ (2 days) ☐ (1 day) ☐ (same day) ☐											
SEAL PRESENT ☒		YES		NO		COOLER ID #		SEAL PRESENT ☒		YES		NO		COOLER ID #		SEAL PRESENT ☒		YES		NO		COOLER ID #		SEAL PRESENT ☒		YES		NO		COOLER ID #		Date Required			
SEAL INTACT ☒		TEMP °C		<u>5</u>		<u>2</u>		SEAL INTACT ☒		TEMP °C		<u>5</u>		<u>1</u>		SEAL INTACT ☒		TEMP °C		<u>5</u>		<u>2</u>		SEAL INTACT ☒		TEMP °C		<u>5</u>		<u>1</u>		LAB USE ONLY			
COOLING MEDIA PRESENT ☒		1		2		3		COOLING MEDIA PRESENT ☒		1		2		3		COOLING MEDIA PRESENT ☒		1		2		3		COOLING MEDIA PRESENT ☒		1		2		3		MAXXAM JOB #			
RELINQUISHED BY: <u>Stacy Gibb</u>				DATE: <u>2021/09/20</u>				TIME (24 HR): <u>10:00</u>				RECEIVED BY: <u>Kristyil Avila</u>				DATE: <u>2021/09/22</u>				TIME (24 HR): <u>15:30</u>				SAMPLES											
1. <u>Stacy Gibb</u>				2. <u>Stacy Gibb</u>				3. <u>Stacy Gibb</u>				1. <u>Kristyil Avila</u>				2. <u>Kristyil Avila</u>				3. <u>Kristyil Avila</u>				LABELED BY: <u>NMU</u>				VERIFIED BY: <u>AIN</u>							



Appendix E

Quality Assurance/Quality Control

Quality Assurance/Quality Control (QA/QC)

Field QA/QC Program

The groundwater field QA/QC program for the SNP consisted of four field duplicate samples for the analysis of dissolved chloride and BTEX parameters. One trip blank sample was also submitted for analysis of PHCs as part of the 2021 field program.

For the field duplicate samples, the QA/QC results were evaluated by calculating the relative percent difference (RPD) between the parent and duplicate sample results and comparison of the RPD to designated alert limits.

The RPD is calculated using the following formula:

$$\text{RPD \%} = \left(\frac{|x_1 - x_2|}{(x_1 + x_2)/2} \right) * 100$$

Where x_1 = original field sample

x_2 = blind field duplicate sample

Consistent with laboratory practices and to permit reliable calculations, an RPD is only considered to be statistically relevant when the original and duplicate sample concentrations are at least five times the reportable detection limit. These limits vary parameter to parameter and sample to sample and are indicated by the laboratory alongside the analytical results in the Certificates of Analysis (Appendix D).

The designated field duplicate RPD alert limits are presented in the analytical tables. All field duplicate RPDs were within the designated alert limits (<50% for dissolved chloride and <80% for BTEX).

The designated trip blank alert limits are >5X the reportable detection limit (RDL) for BTEX. The blank submitted during the spring SNP sampling program was compared to the alert limits and is presented in Table E-1. All of the results were below the RDLs.

Laboratory QA/QC Program

The laboratory QA/QC program consisted of one or more of the following analyses:

- instrument and extraction surrogate recoveries for samples that were analyzed; and
- the analysis of method blank, laboratory duplicate, matrix spike and/or laboratory control samples for the sample analytical batches that were analyzed.

The laboratory QA/QC results are presented in the certificates of analysis (Appendix D). There were no QA/QC laboratory issues identified that impact the primary SNP parameters (dissolved chloride and BTEX).

No field or laboratory QA/QC issues were identified that would affect the overall conclusions presented in this report. Overall, the results reported are considered to be reliable.

Field and Trip Blanks: Petroleum Hydrocarbons (PHCs)

PROJECT No.: 417085-31872							
Sampling Location	Date (dd-mmm-yyyy)	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	m&p-Xylene (mg/L)	o-Xylene (mg/L)	Xylenes (Total) (mg/L)
Laboratory Reportable Detection Limit		0.00040	0.00040	0.00040	0.00080	0.00040	0.00089
Alert Limits		5 x RDL	5 x RDL	5 x RDL	5 x RDL	5 x RDL	5 x RDL
QA/QC Samples							
Groundwater Trip Blank	20-Aug-2021	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.00040	< 0.00089

NOTES:

1. Highlighting indicates parameters above alert limits



Appendix F

Mann–Kendall Statistical Analyses

Table F-1
Mann-Kendall Statistical Analysis (1997-2021) - Chloride

Filtered Trend Results, two-sided p-value < 0.05 And Normalized Slope > ± 10%/Year

Location	Count	Mann-Kendall S	Two-sided p-value (for MK test)	Slope (mg/L/year)	Normalized Slope (%/year)	Min (mg/L)	Median (mg/L)	Max (mg/L)
BIBG-10-1-4	13	37	0.02	2.0886	13	3.0	16.0	25
GIP11 09-1-4-R	7	-14	0.04	-6.2024	-44	5.0	14.0	50

Full Mann-Kendall Analysis, Sorted by two-sided p-value

Location	Count	Mann-Kendall S	Two-sided p-value (for MK test)	Slope (mg/L/year)	Normalized Slope (%/year)	Min (mg/L)	Median (mg/L)	Max (mg/L)
TF 03-12-3	26	-216	0.00	-8.5860	-5	72	158.5	280
CPF 98-8-3	30	-212	0.00	-0.3859	-3	6.6	11.5	22
C38 08-1-4	21	-119	0.00	-0.5767	-3	14	20.0	25
MEBG-10-1-3	19	-97	0.00	-0.2251	-10	< 2.0	2.3	5
BIS 97-1-3	24	-127	0.00	-0.3146	-1	16	22.0	35
BI-13-3-4.5	12	-42	0.00	-0.6994	-8	6.0	8.45	13
BIBG-10-1-4	13	37	0.02	2.0886	13	3.0	16.0	25
GIP11 09-1-4-R	7	-14	0.04	-6.2024	-44	5.0	14.0	50
GIQ8-10-2-4	16	44	0.05	0.5186	3	5.8	19.0	21
ARB-12-3-3	17	-46	0.06	-1.2406	-8	7.0	16.0	32
MTF 97-1-5	25	-60	0.16	-0.0240	-2	< 1.0	1.4	3.4
GIP11 09-1-4	7	-9	0.23	-4.5933	-66	3.6	7.0	110
BI-13-1-4	12	-18	0.24	-0.4778	-6	2.5	7.8	9.5
GIBG-10-2-3	17	29	0.24	0.2902	6	< 1.0	5.0	11
BIBG-12-1-7	4	-4	0.30	-0.5959	-7	7.5	8.65	11
WSY 97-1-5	29	55	0.31	0.2915	1	6.5	20.3	64
CPF 97-7-5	31	37	0.54	0.0863	1	7.7	14.0	190



Table F-6
Statistical Summary

Project No.: 417085-31872				Trend Analysis						Upper Control Limit Analysis			Lower Control Limit Analysis			Basic Analysis								Reporting Period		Guideline Analysis		
Location	Monitoring Station	Hydrostatigraphic Unit	Parameter	P Value of Two Tailed Test (-)	Inferred Confidence Level (of Trend Present in Data Set) %	Slope (mg/L/yr)	Normalized Slope (%/yr)	Meets Trend Assumptions? ⁷	Statistically Significant Mann-Kendall Trend ⁵	Visual Trend Assessment ⁹	UCL ⁶ (mg/L)	2021 Values Greater than UCL	Meets UCL Assumptions ⁷	LCL ⁶ (mg/L)	2021 Values Less than LCL	Meets LCL Assumptions ⁷	Historical								Count	Max	Guideline Value ⁸	2021 Guideline Exceedances
																	Count	Min (mg/L)	Median (mg/L)	Max (mg/L)	Range	Variability ⁴	Avg. (mg/L)	Std. Dev. (mg/L)				
ARB-12-3-3	ARB-12-3-3	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	17	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	2	< 0.00040	0.37	0
ARB-12-3-3			Chloride	0.062887	0.9371	-1.2406	-7.7540	Y	---	---	50.826	0	Y	NC	NA	N (LCL <0)	17	7.0	16.0	32	25.00	1.56	16.9294	7.5329	2	11	120	0
ARB-12-3-3			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	17	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	2	< 0.00040	0.09	0
ARB-12-3-3			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	17	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	2	< 0.00040	0.002	0
ARB-12-3-3	C38 08-1-4	Surficial Sediments	Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	17	< 0.00080	0.0004	< 0.00089	NC	NC	NC	NC	2	< 0.00089	---	---
C38 08-1-4			Benzene	0.003	0.997	NC	NC	N (ins. trend data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (LCL <0)	21	< 0.0004	0.0002	0.00093	0.00073	3.65	0.0003	0.0002	2	0.0058	0.37	0
C38 08-1-4			Chloride	0.002961	0.997	-0.5767	-2.8834	Y	---	---	33.262	0	Y	6.643	0	Y	21	14	20.0	25	11.00	0.55	19.9523	2.9576	2	16	120	0
C38 08-1-4			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	21	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	2	< 0.00040	0.09	0
C38 08-1-4			ar	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	21	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	2	< 0.00040	0.002	0
C38 08-1-4			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	21	< 0.0008	0.0004	< 0.00089	NC	NC	NC	NC	2	< 0.00089	---	---
CPF 97-7-5	CPF 97-7-5	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	29	< 0.0004	0.0002	< 0.0050	NC	NC	NC	NC	2	< 0.00040	0.37	0
CPF 97-7-5			Chloride	0.54	0.4604	0.0863475	0.6168	Y	---	---	171.374	0	Y	NC	NA	N (LCL <0)	31	7.7	14.0	190	182.30	13.02	21.60645	33.281776	2	9.9	120	0
CPF 97-7-5			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	29	< 0.0004	0.0002	< 0.0050	NC	NC	NC	NC	2	< 0.00040	0.09	0
CPF 97-7-5			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	29	< 0.0004	0.0002	< 0.0050	NC	NC	NC	NC	2	< 0.00040	0.002	0
CPF 97-7-5			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	29	< 0.0005	0.0004	< 0.0050	NC	NC	NC	NC	2	< 0.00089	---	---
CPF 98-8-3	CPF 98-8-3	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	30	< 0.0004	0.0002	< 0.0050	NC	NC	NC	NC	2	< 0.00040	0.37	0
CPF 98-8-3			Chloride	1.63E-04	0.9998	-0.3859	-3.3558	Y	---	---	30.503	0	Y	NC	NA	N (LCL <0)	30	6.6	12.0	22	15.40	1.28	11.86667	4.1414	2	8.3	120	0
CPF 98-8-3			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	30	< 0.0004	0.0002	< 0.0050	NC	NC	NC	NC	2	< 0.00040	0.09	0
CPF 98-8-3			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	30	< 0.0004	0.0002	< 0.0050	NC	NC	NC	NC	2	< 0.00040	0.002	0
CPF 98-8-3			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	30	< 0.0005	0.0004	< 0.0050	NC	NC	NC	NC	2	< 0.00089	---	---
MEBG-10-1-3	MEBG-10-1-3	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	19	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	2	< 0.00040	0.37	0
MEBG-10-1-3			Chloride	0.001	0.9993	3.846	-9.7855	Y	---	D	6.812	0	Y	NC	NA	N (LCL <0)	19	< 0.2	2.3	5	NC	NC	2.5947	0.9372	2	3.4	120	0
MEBG-10-1-3			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	19	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	2	< 0.00040	0.09	0
MEBG-10-1-3			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	19	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	2	< 0.00040	0.002	0
MEBG-10-1-3			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	19	< 0.0008	0.0004	< 0.00089	NC	NC	NC	NC	2	< 0.00089	---	---
MTF 97-1-5	MTF 97-1-5	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	21	< 0.0004	0.0002	< 0.0005	NC	NC	NC	NC	2	< 0.00040	0.37	0
MTF 97-1-5			Chloride	0.165	0.8354	-0.02403	-1.7167	Y	---	---	4.541	0	Y	NC	NA	N (LCL <0)	25	< 1.0	1.4	3.4	2.90	2.07	1.384	0.7016	2	1.4	120	0
MTF 97-1-5			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	21	< 0.0004	0.0002	< 0.0005	NC	NC	NC	NC	2	< 0.00040	0.09	0
MTF 97-1-5			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	21	< 0.0004	0.0002	< 0.0005	NC	NC	NC	NC	2	< 0.00040	0.002	0
MTF 97-1-5			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	21	< 0.0005	0.0004	< 0.001	NC	NC	NC	NC	2	< 0.00089	---	---
TF 03-12-3	TF 03-12-3	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	26	< 0.0004	0.0002	0.0017	0.0015	7.50	0.0003	0.0003	2	< 0.00040	0.37	0
TF 03-12-3			Chloride	2.06E-06	1	-8.586	-5.4171	Y	---	D	403.348	0	Y	NC	NA	N (LCL <0)	26	72	158.5	280	208	1.31	157.3077	54.67567	2	84	120	0
TF 03-12-3			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	26	< 0.0004	0.0002	< 0.0005	NC	NC	NC	NC	2	< 0.00040	0.09	0
TF 03-12-3			Toluene</																									



Table F-6
Statistical Summary

Project No.: 417085-31872				Trend Analysis							Upper Control Limit Analysis			Lower Control Limit Analysis			Basic Analysis								Guideline Analysis			
Location	Monitoring Station	Hydrostratigraphic Unit	Parameter	P Value of Two Tailed Test (-)	Inferred Confidence Level (of Trend Present in Data Set) %	Slope (mg/L/yr)	Normalized Slope (%/yr)	Meets Trend Assumptions? ⁷	Statistically Significant Mann- Kendall Trend ⁵	Visual Trend Assessment ⁹	UCL ⁶ (mg/L)	2021 Values Greater than UCL	Meets UCL Assumptions ⁷	LCL ⁶ (mg/L)	2021 Values Less than LCL	Meets LCL Assumptions ⁷	Historical								Reporting Period		Guideline Value ⁸	2021 Guideline Exceedances
																	Count	Min (mg/L)	Median (mg/L)	Max (mg/L)	Range	Variability ⁴	Avg. (mg/L)	Std. Dev. (mg/L)	Count	Max		
BIBG-12-1-7	BIBG-12-1-7	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	4	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	0	---	0.37	0
BIBG-12-1-7			Chloride	0.30818	0.6918	-0.595866402	-6.88863	Y	---	---	15.868	NA	Y	NC	NA	N (ins. data)	4	7.5	8.65	11	3.5	0.40	8.9500	1.5373	0	---	120	0
BIBG-12-1-7			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	4	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	0	---	0.09	0
BIBG-12-1-7			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	4	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	0	---	0.002	0
BIBG-12-1-7			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	4	< 0.00080	0.0004	< 0.00080	NC	NC	NC	NC	0	---	---	---
BIS 97-1-3	BIS 97-1-3	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	20	< 0.0004	0.0002	< 0.0005	NC	NC	NC	NC	2	< 0.00040	0.37	0
BIS 97-1-3			Chloride	0.002	0.9984	-0.3146	-1.4299	Y	---	---	42.123	0	Y	3.168	0	Y	24	16	22.0	35	19	0.86	22.64583	4.3283	2	< 0.00040	120	0
BIS 97-1-3			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	20	< 0.0004	0.0002	< 0.0005	NC	NC	NC	NC	2	< 0.00040	0.09	0
BIS 97-1-3			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	20	< 0.0004	0.0002	< 0.0005	NC	NC	NC	NC	2	< 0.00040	0.002	0
BIS 97-1-3			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	20	< 0.0005	0.000445	< 0.0015	NC	NC	NC	NC	2	< 0.00089	---	---
GIBG-10-2-3	GIBG-10-2-3	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	17	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	0	---	0.37	0
GIBG-10-2-3			Chloride	0.248347	0.7517	0.2902	5.8044	Y	---	---	18.425	0	Y	NC	NA	N (LCL <0)	17	< 1.0	5.0	11	10.5	2.10	5.0059	2.9819	0	---	120	0
GIBG-10-2-3			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	17	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	0	---	0.09	0
GIBG-10-2-3			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	17	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	0	---	0.002	0
GIBG-10-2-3			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	17	< 0.0008	0.0004	< 0.00089	NC	NC	NC	NC	0	---	---	---
GIP11 09-1-4	GIP11 09-1-4	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	7	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	0	---	0.37	0
GIP11 09-1-4			Chloride	0.229556	0.7704	-4.5933	-65.618	Y	---	---	197.673	NA	Y	NC	NA	N (LCL <0)	7	3.6	7.0	110	106.4	15.20	24.2000	38.5496	0	---	120	0
GIP11 09-1-4			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	7	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	0	---	0.09	0
GIP11 09-1-4			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	7	< 0.0004	0.0002	< 0.0004	NC	NC	NC	NC	0	---	0.002	0
GIP11 09-1-4			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	7	< 0.0008	0.0004	< 0.0008	NC	NC	NC	NC	0	---	---	---
GIP11 09-1-4-R	GIP11 09-1-4-R	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	7	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	1	< 0.00040	0.37	0
GIP11 09-1-4-R			Chloride	0.048	0.9517	-6.2024	-44.3026	Y	D	---	87.058	0	Y	NC	NA	N (LCL <0)	7	5.0	14.0	50	45	3.21	15.9	15.8129	1	5.4	120	0
GIP11 09-1-4-R			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	7	< 0.00040	0.0002	< 0.00040	NC	NC	NC	0.0000	1	< 0.00040	0.09	0
GIP11 09-1-4-R			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	7	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	1	< 0.00040	0.002	0
GIP11 09-1-4-R			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	7	< 0.00089	0.000445	< 0.00089	NC	NC	NC	NC	1	< 0.00089	---	---
GIQ8-10-2-4	GIQ8-10-2-4	Surficial Sediments	Benzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	16	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	2	< 0.00040	0.37	0
GIQ8-10-2-4			Chloride	0.052	0.9482	0.5186	2.7297	Y	---	---	43.118	0	Y	NC	NA	N (LCL <0)	16	5.8	19.0	21			15.6625	6.1011	2	21	120	0
GIQ8-10-2-4			Ethylbenzene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	16	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	2	< 0.00040	0.09	0
GIQ8-10-2-4			Toluene	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	16	< 0.00040	0.0002	< 0.00040	NC	NC	NC	NC	2	< 0.00040	0.002	0
GIQ8-10-2-4			Xylenes-Total	NC	NC	NC	NC	N (ins. >DL data)	---	---	NC	NA	N (ins. >DL data)	NC	NA	N (ins. >DL data)	16	< 0.00080	0.0004	0.0016	15.2	0.8	0.000494688	0.000295604	2	0.16	---	---

1. Bold formatting indicates a value is above the applied guideline
- The following results have been checked against the guideline: minimum, median, maximum, average, LCL, UCL

2. Shading in the parameter column indicates one or more analyses returned notable results (analysis-specific shading is further specified below)

3. Basic analysis performed with the following conditions:
- Historical: all data before 01-Jan-2021
- Reporting period is defined as 01-Jan-2021 to 31-Dec-2021 (inclusive)
- Non-detect multiplier of 0.5 applied to <DL sample data

4. Variability calculated as range / median

5. Trend Analysis:
- Analyses performed on all sample data before 31-Dec-2021 (inclusive)
- Non-detect multiplier of 0.5 applied to <DL sample data
- Statistically significant trend defined as:
-- Inferred confidence level greater than 95%
(in other words, P-value of two-tailed test is less than or equal to 0.05)
-- Absolute value of Sen's normalized slope is greater than 10%
- U: Denotes statistically significant upward trend
- D: Denotes statistically significant downward trend
- "----": Denotes no trend
- Shading of trend analysis cells indicates a Mann-Kendall trend has been detected

6. Upper Control Limit (UCL) and Lower Control Limit (LCL) calculated as follows:
- Calculated on all data before 31-Dec-2021 (inclusive)
- Minimum 8 data points; no maximum number of data points
- Non-detect multiplier of 0.5 applied to <DL sample data
- Control limit exceedances reported on sample data between 01-Jan-2021 and 31-Dec-2021 (inclusive)
- Shading of control limit cells indicates one or more control limit exceedances were detected

7. Legend for control limit/trend assumptions:
- Y: All conditions are met
- N: Not all conditions are met, specified as follows:
-- No new data: No sample data present for years reported
-- LCL < 0: calculated LCL was less than 0
-- ins. CL data: insufficient data to calculate a control limit
-- ins. trend data: insufficient data to calculate a trend
-- ins. >DL data: Less than 50% of control limit data was above detection limit
-- ins. >DL data: Less than 50% of trend data was above detection limit
-- UCL <2x/<5x RD L: The UCL is less than twice/less than 5 times the reporting detection limit
-- U Trend: An upward Mann-Kendall trend is present
-- D Trend: A downward Mann-Kendall trend is present

8. Guideline: Canadian Environmental Quality Guidelines Summary Table. Water Quality Guidelines for the Protection of Freshwater Aquatic Life. <http://st-ts.ccm.ca/?chems=all&chapters=1>
- Chloride guideline based on chronic exposure

9. Visual Trend Assessment includes: trend reversals, trend stabilizations, possible developing trends, and probable (monotonic) trends

Table F-2
Mann-Kendall Statistical Analysis (1998-2021) - Benzene

Filtered Trend Results, two-sided p-value < 0.05 And Normalized Slope > ± 10%/Year

Location	Count	Mann-Kendall S	Two-sided p-value (for MK test)	Slope (mg/L/year)	Normalized Slope (%/year)	Min (mg/L)	Median (mg/L)	Max (mg/L)
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Full Mann-Kendall Analysis, Sorted by two-sided p-value

Location	Count	Mann-Kendall S	Two-sided p-value (for MK test)	Slope (mg/L/year)	Normalized Slope (%/year)	Min (mg/L)	Median (mg/L)	Max (mg/L)
CPF 98-8-3	30	-195	0.00	0.0000	0	< 0.0004	0.0002	< 0.0050
CPF 97-7-5	29	-176	0.00	0.0000	0	< 0.0004	0.0002	< 0.0050
WSY 97-1-5	27	-126	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
BIS 97-1-3	20	-84	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
TF 03-12-3	26	-101	0.00	0.0000	0	< 0.0004	0.0002	0.0017
C38 08-1-4	21	74	0.00	0.0000	0	< 0.0004	0.0002	0.00093
MTF 97-1-5	21	-54	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
BI-13-3-4.5	12	-5	0.56	0.0000	0	< 0.00040	0.0002	0.00042
MEBG-10-1-3	19	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
ARB-12-3-3	17	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
GIBG-10-2-3	17	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
GIQ8-10-2-4	16	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
BIBG-10-1-4	13	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
BI-13-1-4	11	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
GIP11 09-1-4	7	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
GIP11 09-1-4-R	7	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
BIBG-12-1-7	4	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040

Table F-3
Mann-Kendall Statistical Analysis (1998-2021) - Toluene

Filtered Trend Results, two-sided p-value < 0.05 And Normalized Slope > ± 10%/Year

Location	Count	Mann-Kendall S	Two-sided p-value (for MK test)	Slope (mg/L/year)	Normalized Slope (%/year)	Min (mg/L)	Median (mg/L)	Max (mg/L)
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Full Mann-Kendall Analysis, Sorted by two-sided p-value

Location	Count	Mann-Kendall S	Two-sided p-value (for MK test)	Slope (mg/L/year)	Normalized Slope (%/year)	Min (mg/L)	Median (mg/L)	Max (mg/L)
CPF 98-8-3	30	-201	0.00	0.0000	0	< 0.0004	0.0002	< 0.0050
CPF 97-7-5	29	-181	0.00	0.0000	0	< 0.0004	0.0002	< 0.0050
WSY 97-1-5	27	-126	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
BIS 97-1-3	20	-84	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
TF 03-12-3	26	-88	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
MTF 97-1-5	21	-54	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
C38 08-1-4	21	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
MEBG-10-1-3	19	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
ARB-12-3-3	17	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
GIBG-10-2-3	17	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
GIQ8-10-2-4	16	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
BIBG-10-1-4	13	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
BI-13-3-4.5	12	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
BI-13-1-4	11	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
GIP11 09-1-4	7	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
GIP11 09-1-4-R	7	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
BIBG-12-1-7	4	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040

Table F-4
Mann-Kendall Statistical Analysis (1998-2021) - Ethylbenzene

Filtered Trend Results, two-sided p-value < 0.05 And Normalized Slope > ± 10%/Year

Location	Count	Mann-Kendall S	Two-sided p-value (for MK test)	Slope (mg/L/year)	Normalized Slope (%/year)	Min (mg/L)	Median (mg/L)	Max (mg/L)
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Full Mann-Kendall Analysis, Sorted by two-sided p-value

Location	Count	Mann-Kendall S	Two-sided p-value (for MK test)	Slope (mg/L/year)	Normalized Slope (%/year)	Min (mg/L)	Median (mg/L)	Max (mg/L)
CPF 98-8-3	30	-195	0.00	0.0000	0	< 0.0004	0.0002	< 0.0050
CPF 97-7-5	29	-176	0.00	0.0000	0	< 0.0004	0.0002	< 0.0050
WSY 97-1-5	27	-126	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
BIS 97-1-3	20	-84	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
TF 03-12-3	26	-88	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
MTF 97-1-5	21	-54	0.00	0.0000	0	< 0.0004	0.0002	< 0.0005
C38 08-1-4	21	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
MEBG-10-1-3	19	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
ARB-12-3-3	17	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
GIBG-10-2-3	17	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
GIQ8-10-2-4	16	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
BIBG-10-1-4	13	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
BI-13-3-4.5	12	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
BI-13-1-4	11	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
GIP11 09-1-4	7	0	1.00	0.0000	0	< 0.0004	0.0002	< 0.0004
GIP11 09-1-4-R	7	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040
BIBG-12-1-7	4	0	1.00	0.0000	0	< 0.00040	0.0002	< 0.00040

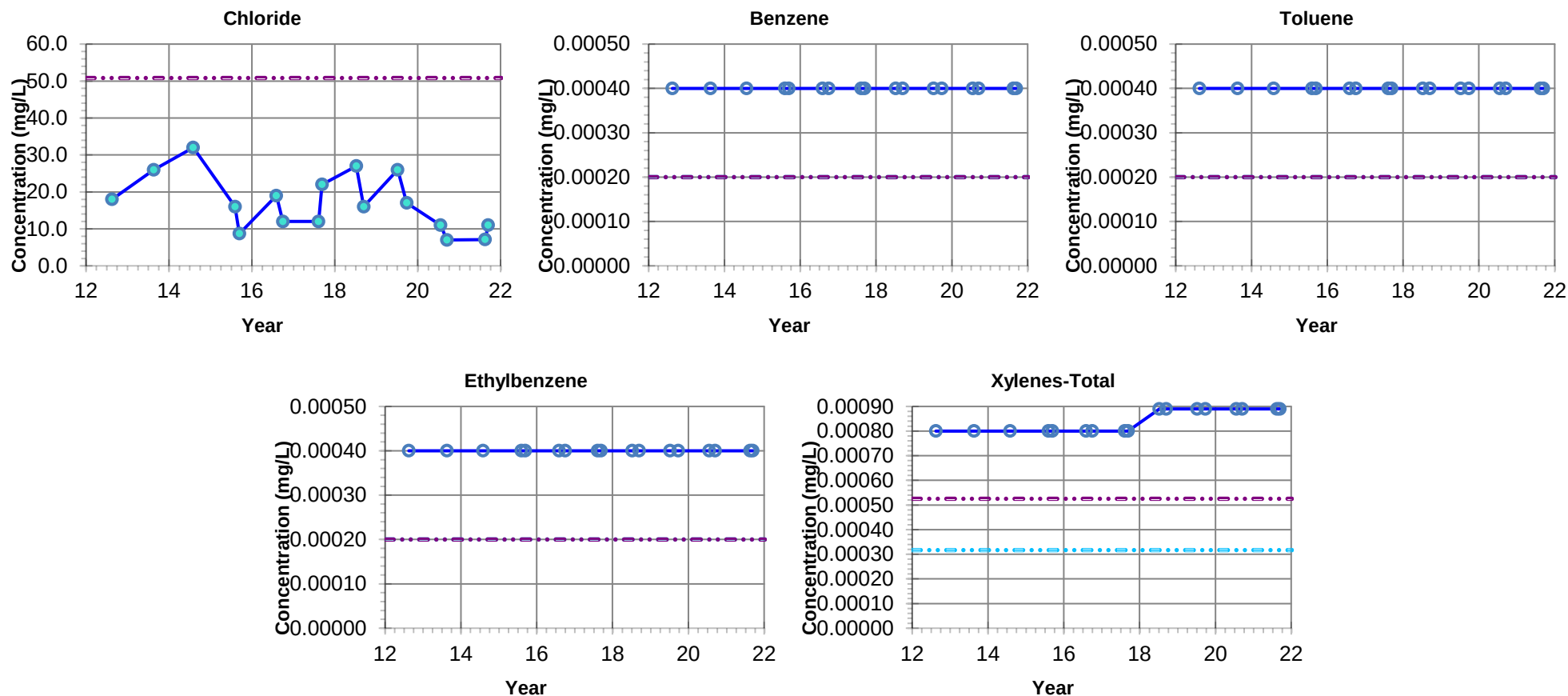
Table F-5
Mann-Kendall Statistical Analysis (1998-2021) - Xylenes-Total

Filtered Trend Results, two-sided p-value < 0.05 And Normalized Slope > ± 10%/Year

Location	Count	Mann-Kendall S	Two-sided p-value (for MK test)	Slope (mg/L/year)	Normalized Slope (%/year)	Min (mg/L)	Median (mg/L)	Max (mg/L)
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Full Mann-Kendall Analysis, Sorted by two-sided p-value

Location	Count	Mann-Kendall S	Two-sided p-value (for MK test)	Slope (mg/L/year)	Normalized Slope (%/year)	Min (mg/L)	Median (mg/L)	Max (mg/L)
C38 08-1-4	21	104	0.00	0.0000	0	< 0.0008	0.0004	< 0.00089
GIQ8-10-2-4	16	69	0.00	0.0000	2	< 0.00080	0.0004225	0.0016
MEBG-10-1-3	19	88	0.00	0.0000	1	< 0.0008	0.0004	< 0.00089
ARB-12-3-3	17	72	0.00	0.0000	1	< 0.00080	0.0004	< 0.00089
GIBG-10-2-3	17	66	0.00	0.0000	0	< 0.0008	0.0004	< 0.00089
BIBG-10-1-4	13	40	0.00	0.0000	1	< 0.0008	0.0004	< 0.00089
BI-13-3-4.5	12	36	0.01	0.0000	2	< 0.00080	0.0004225	< 0.00089
BI-13-1-4	11	30	0.01	0.0000	1	< 0.00080	0.000445	< 0.00089
MTF 97-1-5	21	64	0.03	0.0000	0	< 0.0005	0.0004	< 0.001
WSY 97-1-5	27	71	0.11	0.0000	0	< 0.0005	0.0004	< 0.0015
BIS 97-1-3	20	30	0.32	0.0000	0	< 0.0005	0.000445	< 0.0015
TF 03-12-3	26	25	0.55	0.0000	0	< 0.0008	0.0004	< 0.0015
CPF 97-7-5	29	21	0.68	0.0000	0	< 0.0005	0.0004	< 0.0050
CPF 98-8-3	30	1	1.00	0.0000	0	< 0.0005	0.0004225	< 0.0050
GIP11 09-1-4	7	0	1.00	0.0000	0	< 0.0008	0.0004	< 0.0008
GIP11 09-1-4-R	7	0	1.00	0.0000	0	< 0.00089	0.000445	< 0.00089
BIBG-12-1-7	4	0	1.00	0.0000	0	< 0.00080	0.0004	< 0.00080

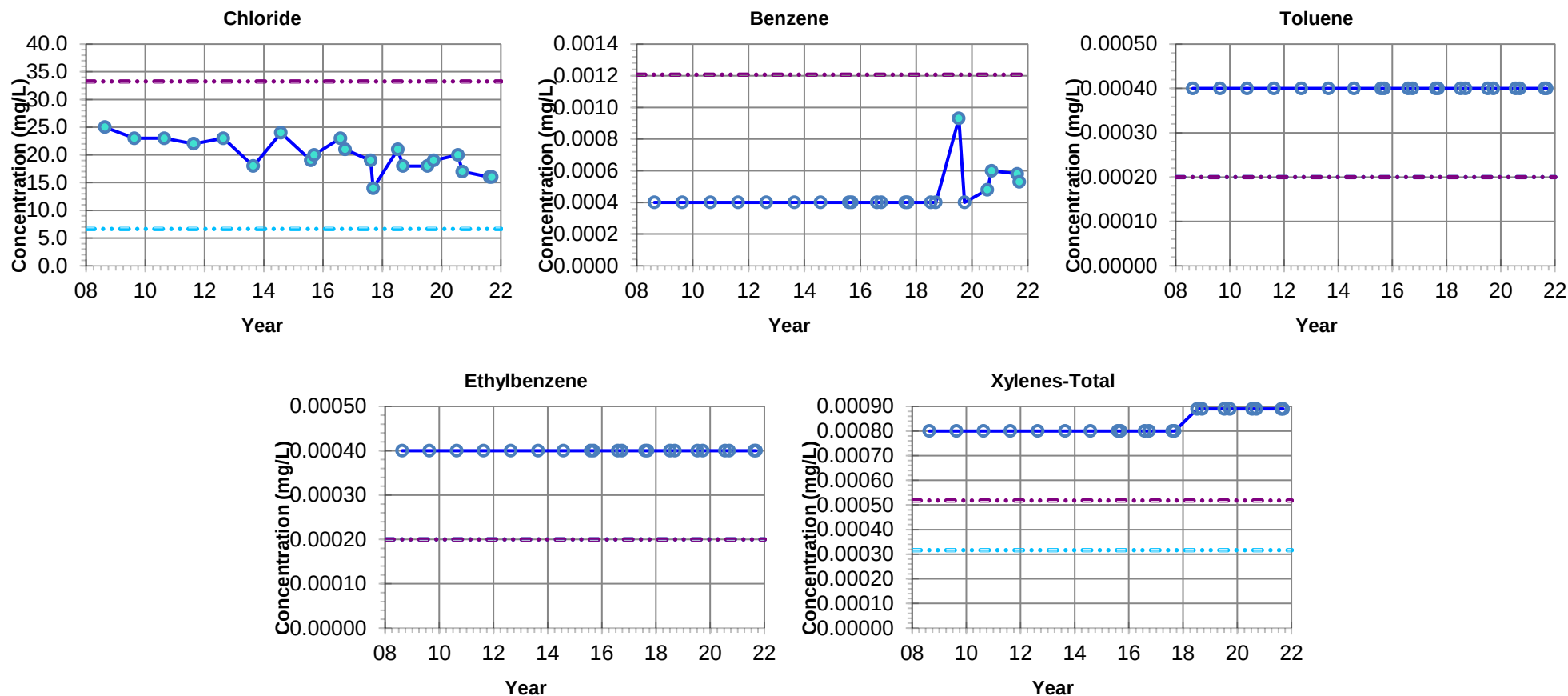


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

- - - Upper Control Limit
 - - - Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: ARB-12-3-3								Advisian Worley Group					
17-Feb-2022		date	NA		edited by	JC		drawn by	NA		app by		
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.										PROJECT NUMBER: 417085-31872-21100		Figure F-1	

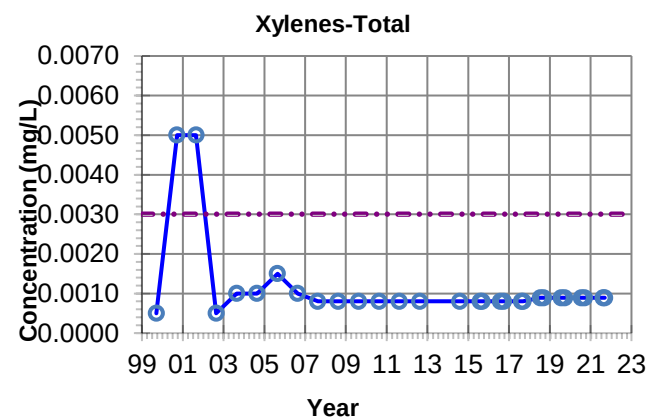
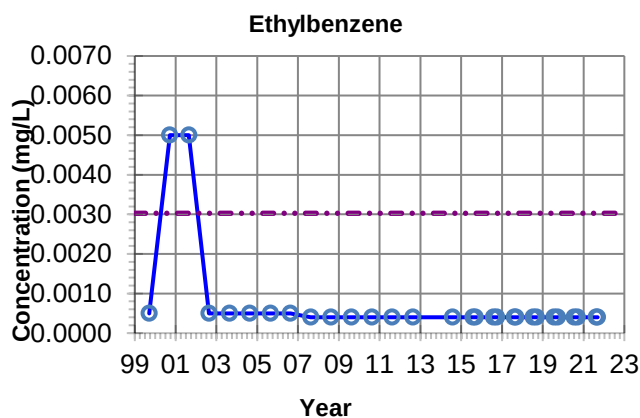
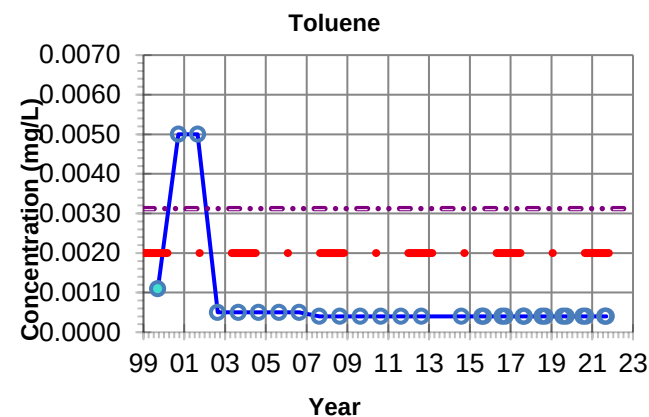
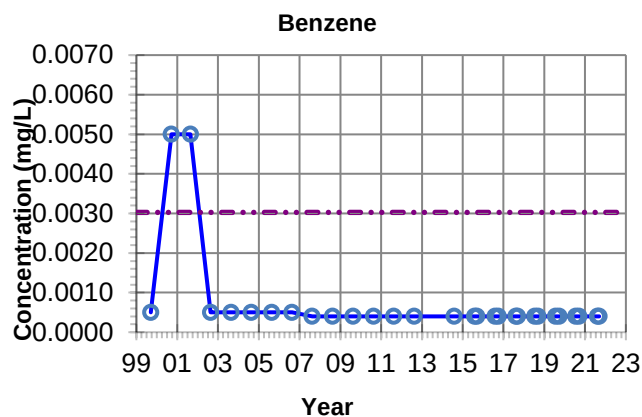
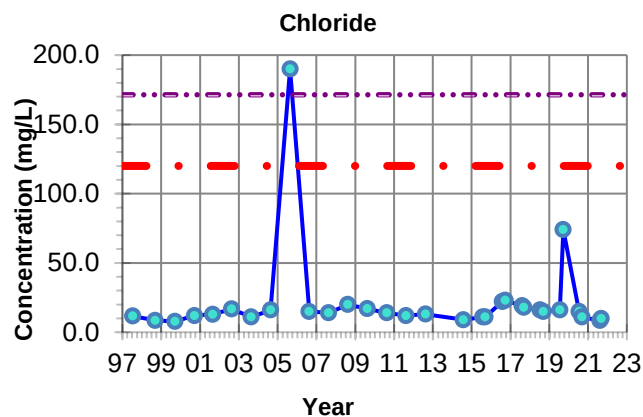


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

--- Upper Control Limit
 --- Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: C38 08-1-4								Advisian Worley Group											
17-Feb-2022		date		NA		edited by		JC		drawn by		NA		app by					
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.																			
PROJECT NUMBER:												417085-31872-21100				Figure		F-2	



NOTES:

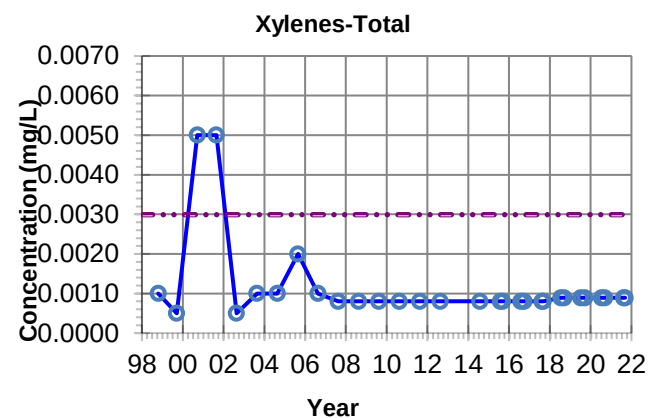
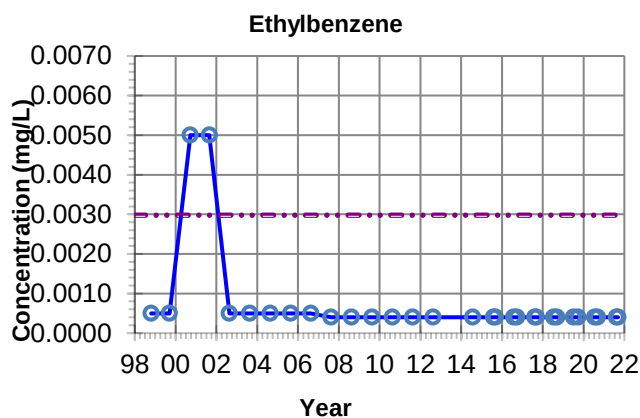
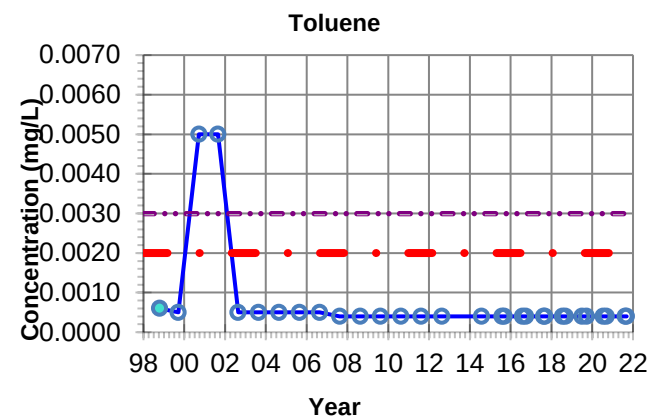
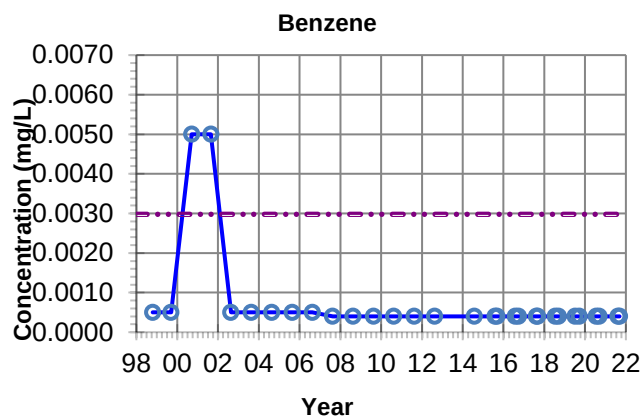
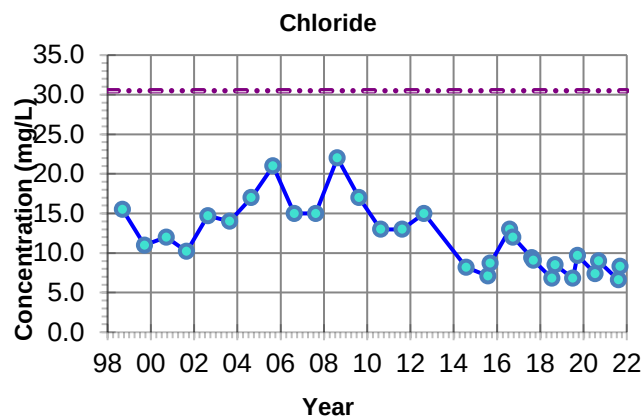
- Filled symbols denote Sample Values
- Unfilled symbols denote Values < Detection Limit(s)

- - - **GUIDELINE:**
CCME CEQG Freshwater Aquatic Life

- Chloride = 120 mg/L
- Benzene = 0.37
- Toluene = 0.002 mg/L
- Ethylbenzene = 0.09 mg/L

- - - **Upper Control Limit**
- - - **Lower Control Limit**

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: CPF 97-7-5								Advisian Worley Group			
17-Feb-2022		date	NA	edited by	JC	drawn by	NA	app by	PROJECT NUMBER:		Figure
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.									417085-31872-21100		F-3



NOTES:

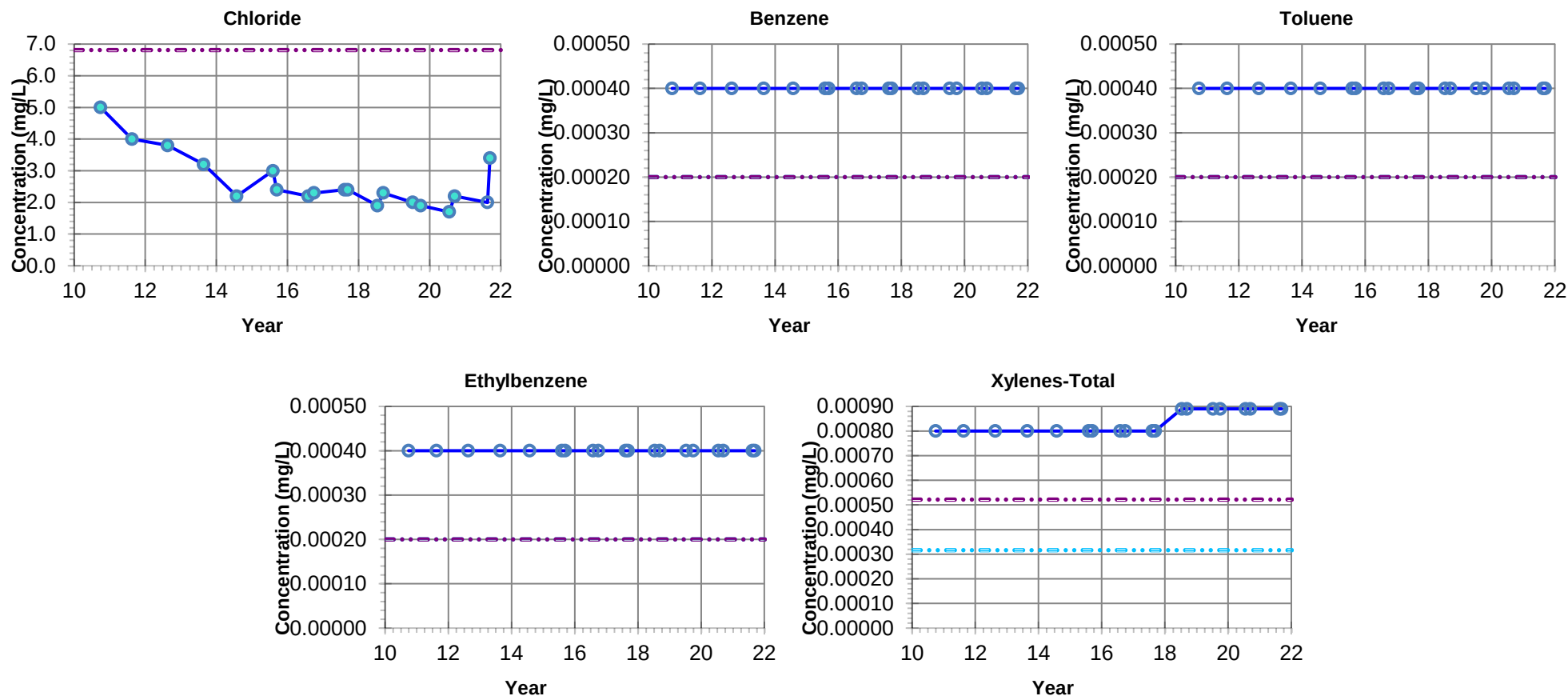
- Filled symbols denote Sample Values
- Unfilled symbols denote Values < Detection Limit(s)

--- **GUIDELINE:**
CCME CEQG Freshwater Aquatic Life

- Chloride = 120 mg/L
- Benzene = 0.37
- Toluene = 0.002 mg/L
- Ethylbenzene = 0.09 mg/L

--- **Upper Control Limit**
--- **Lower Control Limit**

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: CPF 98-8-3								Advisian Worley Group											
17-Feb-2022		date		NA		edited by		JC		drawn by		NA		app by		PROJECT NUMBER:		Figure	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.												417085-31872-21100				F-4			

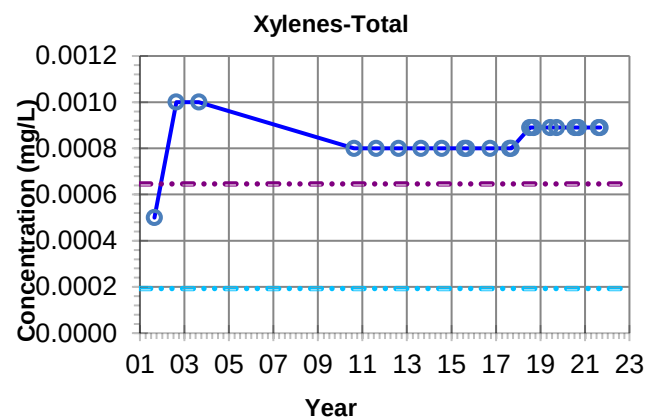
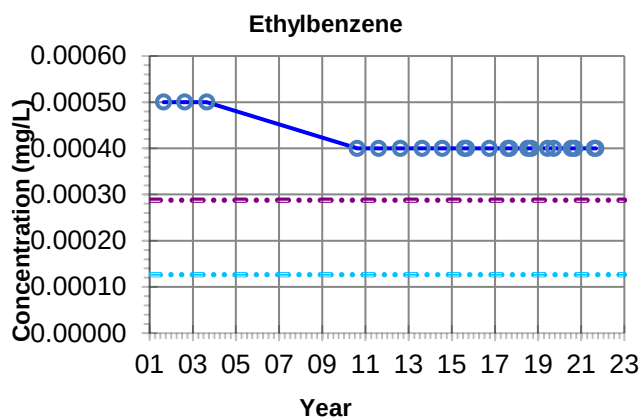
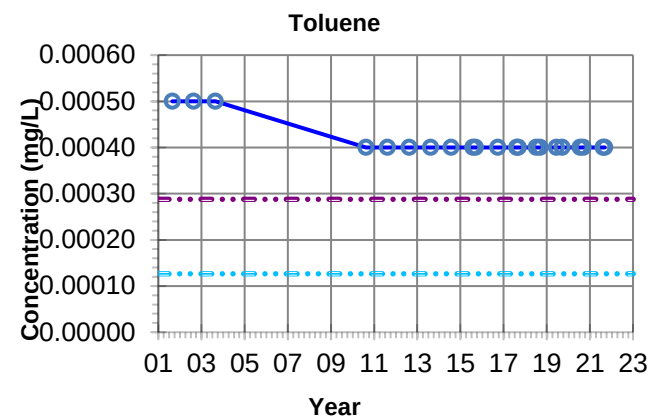
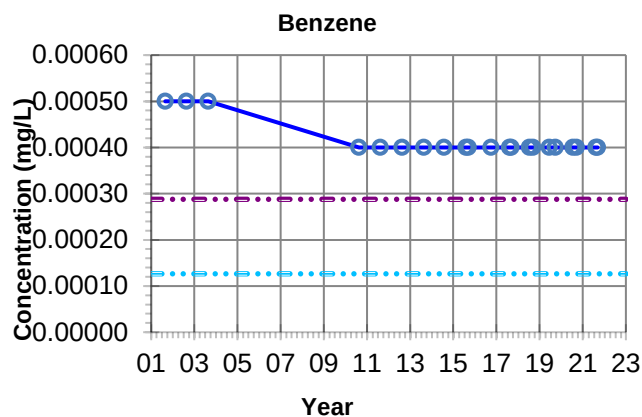
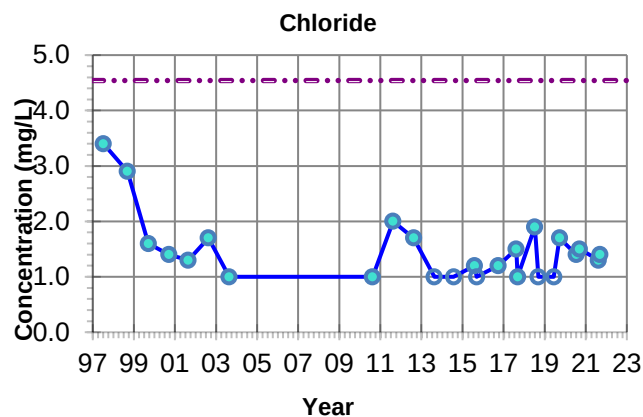


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

--- Upper Control Limit
 --- Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: MEBG-10-1-3								Advisian Worley Group															
17-Feb-2022		date		NA		edited by		JC		drawn by		NA		app by		PROJECT NUMBER:				Figure			
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.																417085-31872-21100				F-5			

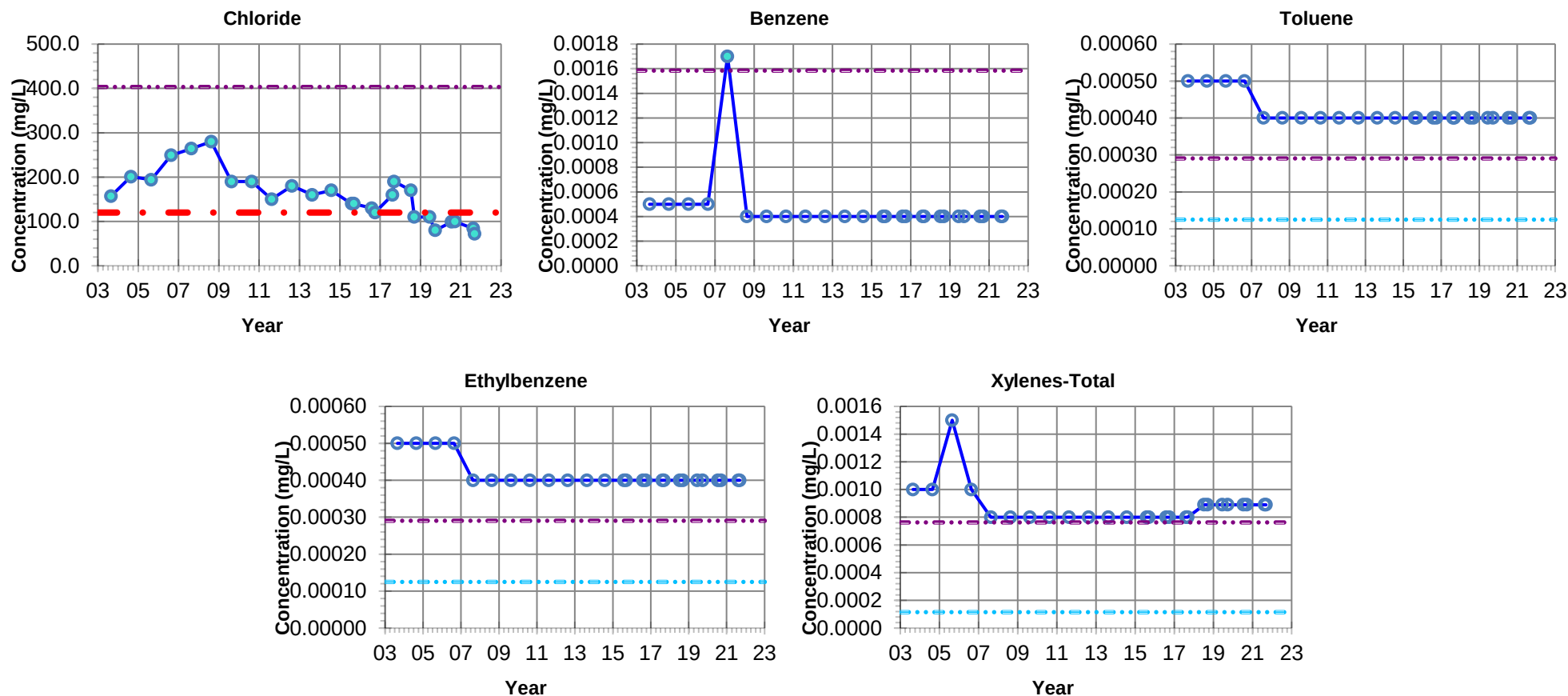


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

- - - **GUIDELINE:**
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

- - - **Upper Control Limit**
 - - - **Lower Control Limit**

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: MTF 97-1-5								Advisian Worley Group			
17-Feb-2022		date	NA	edited by	JC	drawn by	NA	app by	PROJECT NUMBER:		Figure
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.									417085-31872-21100		F-6

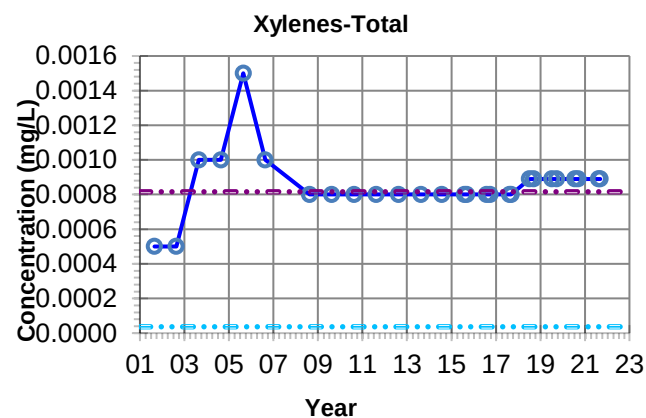
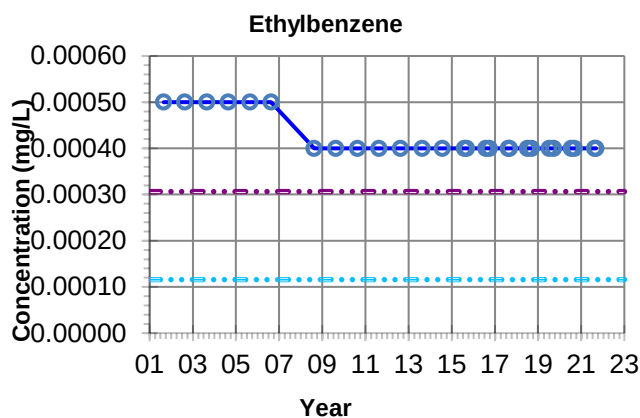
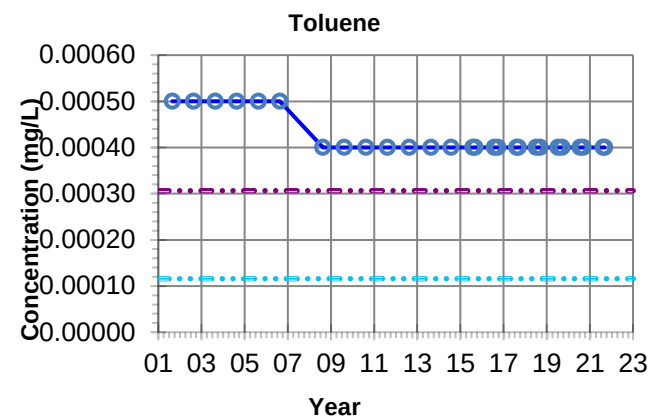
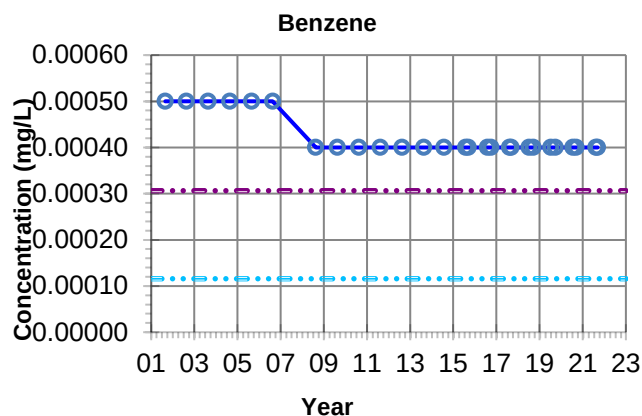
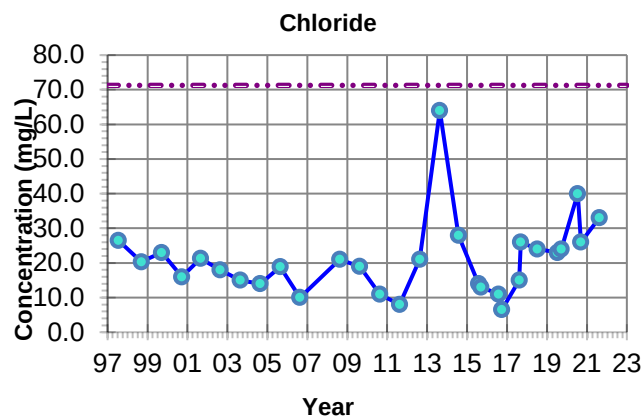


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

- - - Upper Control Limit
 - - - Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: TF 03-12-3								Advisian Worley Group											
17-Feb-2022		date		NA		edited by		JC		drawn by		NA		app by		PROJECT NUMBER:		Figure	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.												417085-31872-21100				F-7			

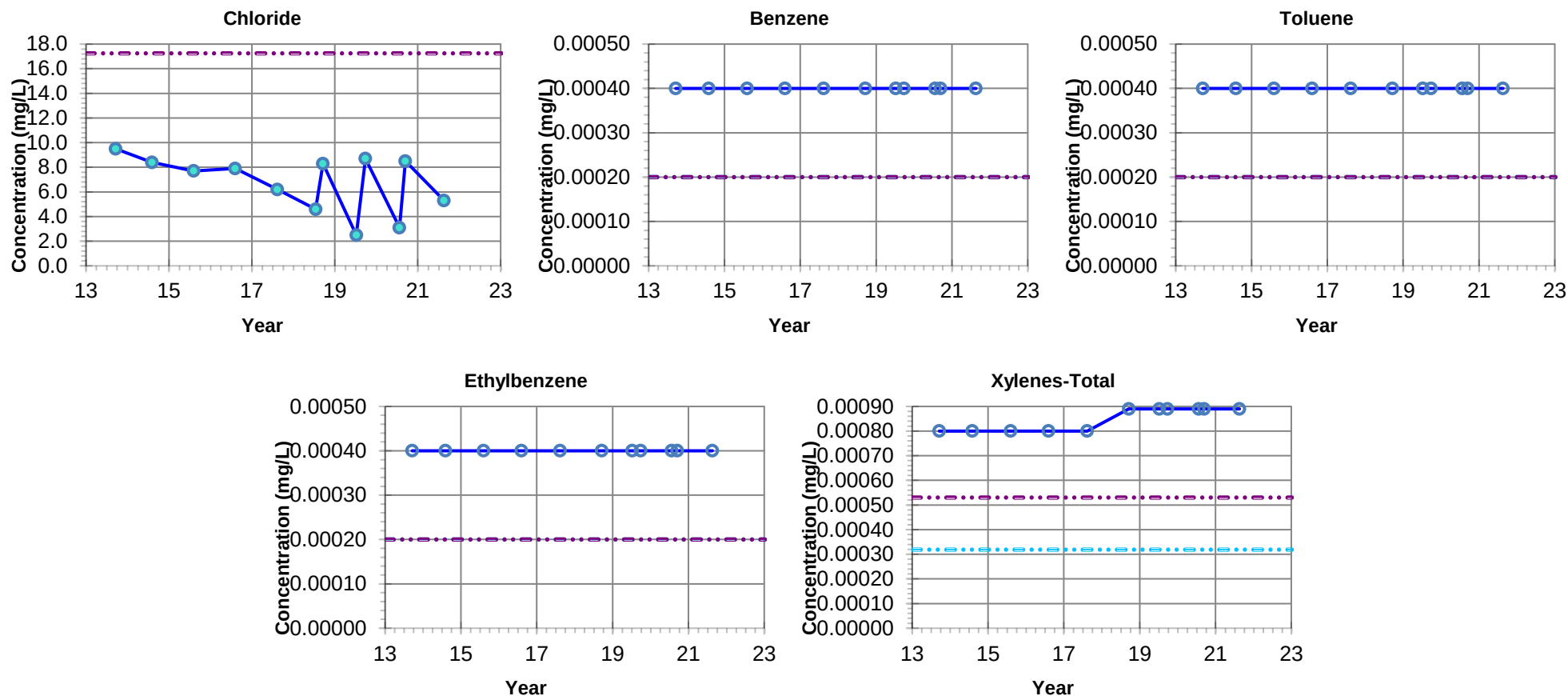


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

--- **GUIDELINE:**
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

--- **Upper Control Limit**
 --- **Lower Control Limit**

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: WSY 97-1-5								Advisian Worley Group							
17-Feb-2022		date	NA		edited by	JC		drawn by	NA		app by	PROJECT NUMBER:		Figure	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.												417085-31872-21100		F-8	

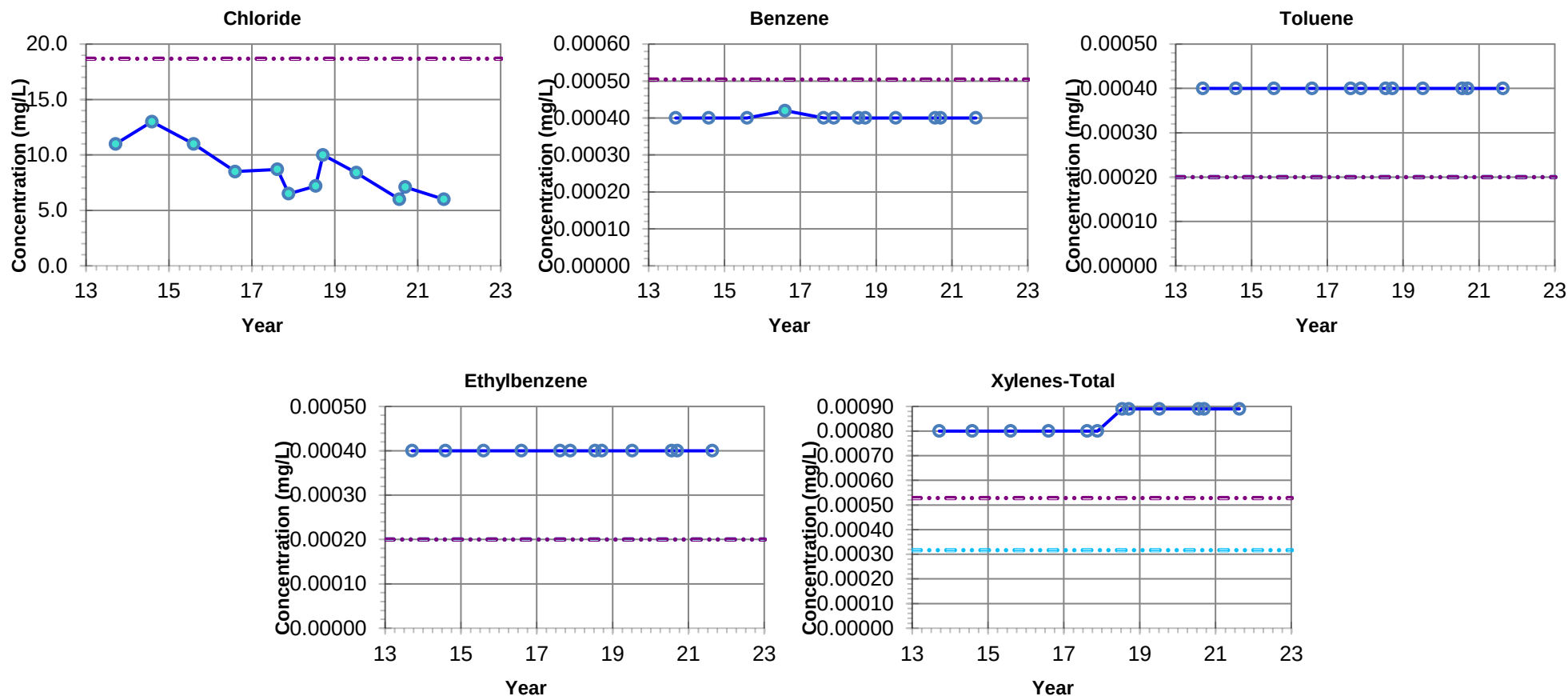


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

- - - Upper Control Limit
 - - - Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: BI-13-1-4								Advisian Worley Group				
17-Feb-2022		date	NA		edited by	JC		drawn by	NA		app by	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.										PROJECT NUMBER:		Figure
										417085-31872-21100		F-9

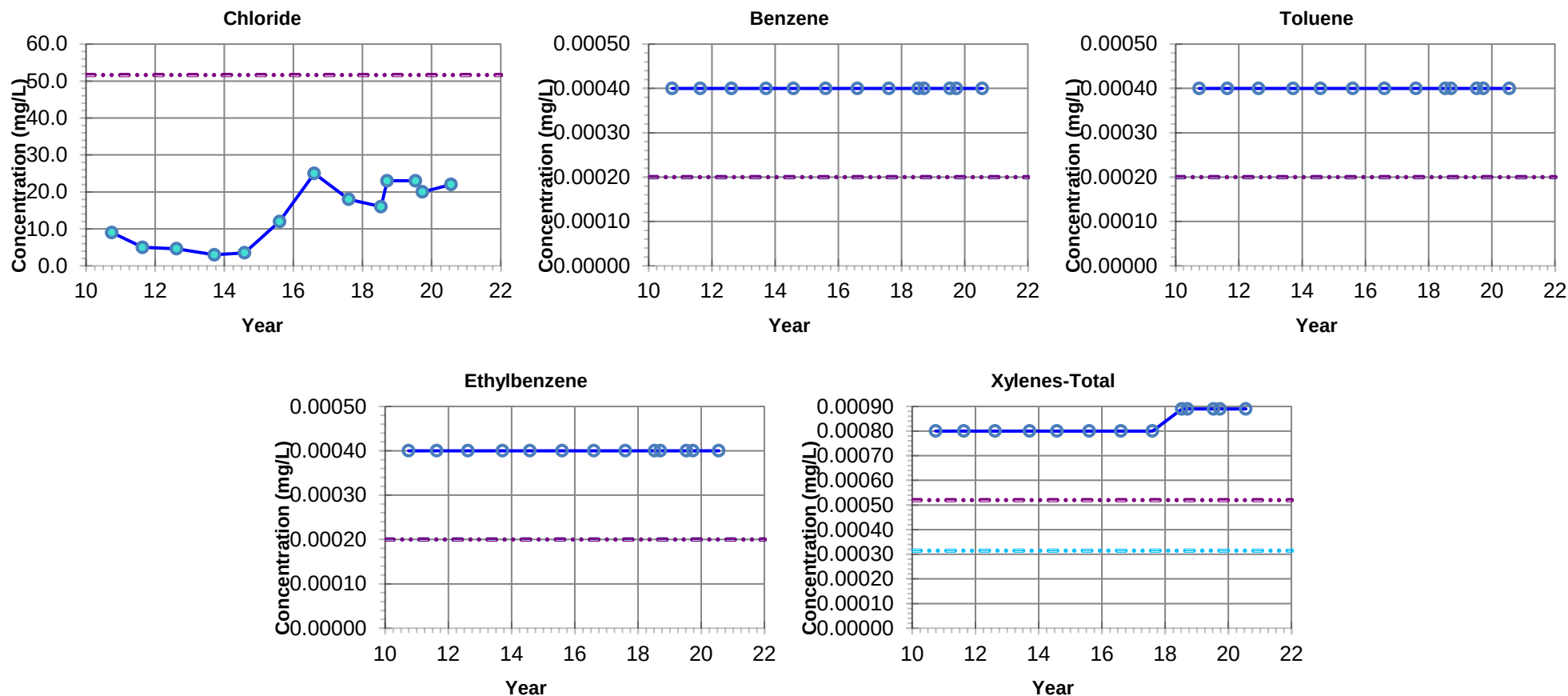


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

--- Upper Control Limit
 --- Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: BI-13-3-4.5								Advisian Worley Group			
17-Feb-2022		date	NA	edited by	JC	drawn by	NA	app by	PROJECT NUMBER:		Figure
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.									417085-31872-21100		F-10

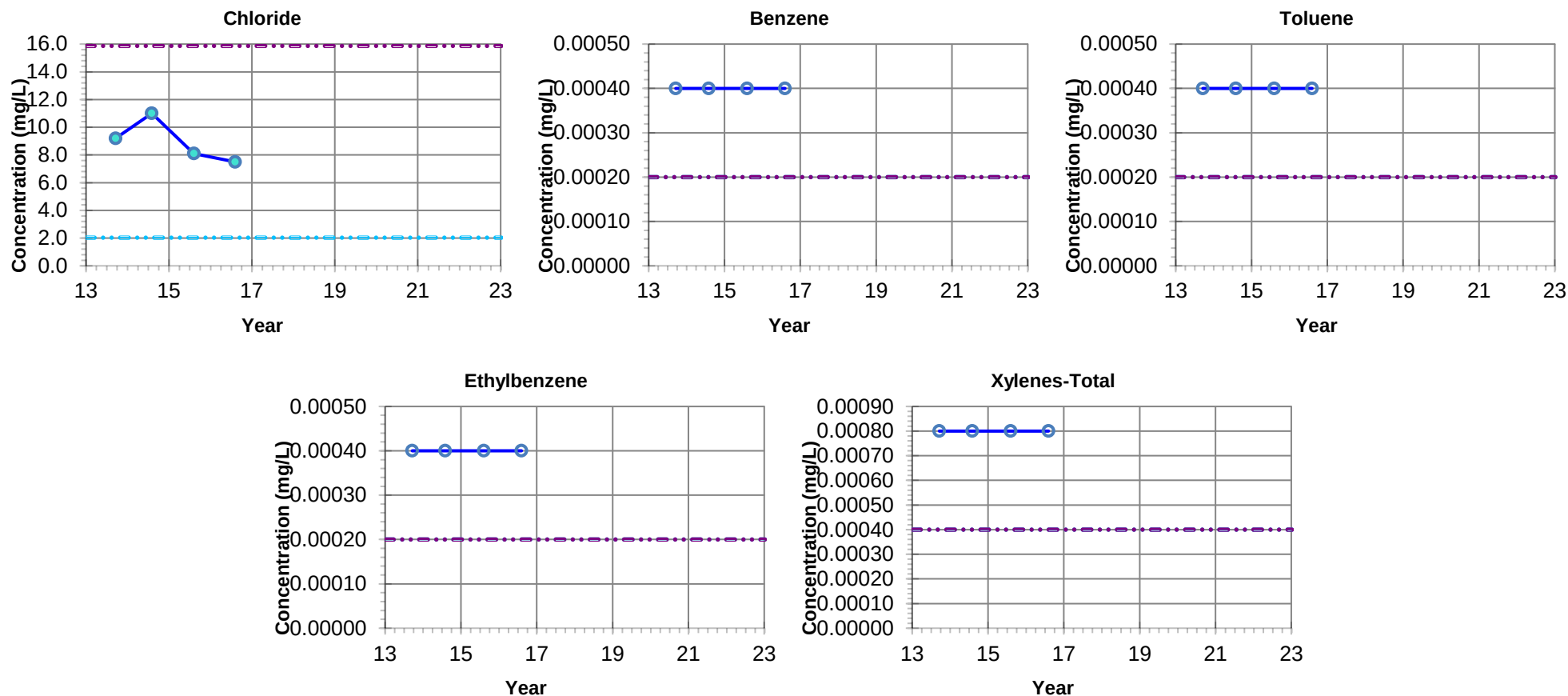


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

--- Upper Control Limit
 --- Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: BIBG-10-1-4								Advisian Worley Group				
17-Feb-2022		date	NA		edited by	JC		drawn by	NA		app by	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.										PROJECT NUMBER: 417085-31872-21100		Figure F-11

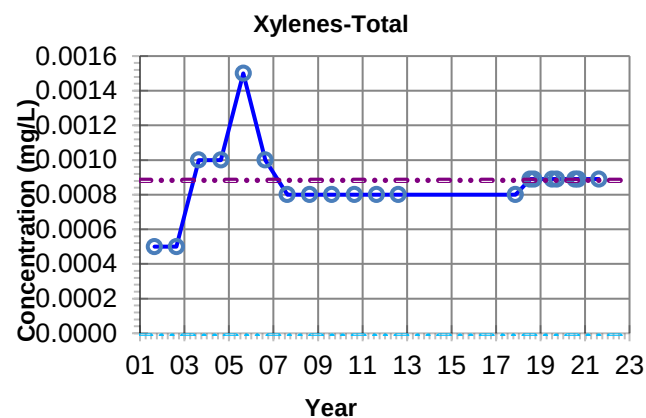
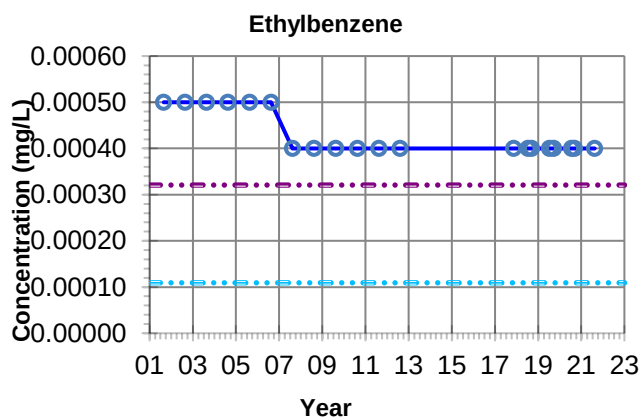
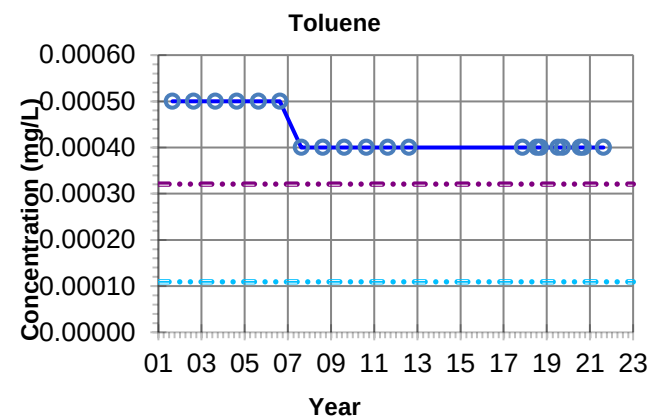
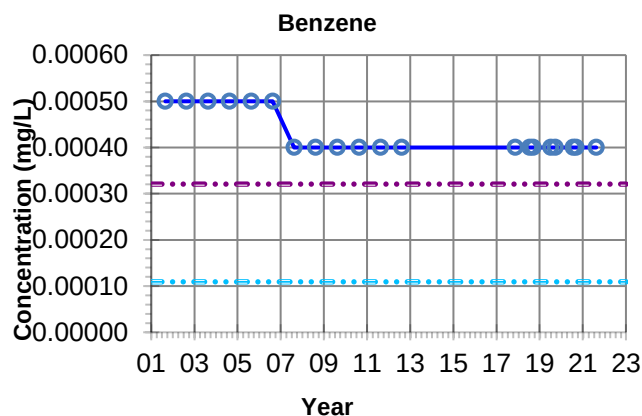
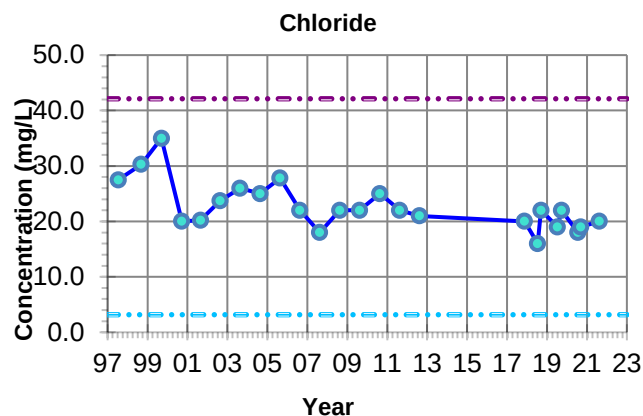


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

--- Upper Control Limit
 --- Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: BIBG-12-1-7								Advisian Worley Group											
17-Feb-2022		date		NA		edited by		JC		drawn by		NA		app by		PROJECT NUMBER:		Figure	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.												417085-31872-21100				F-12			



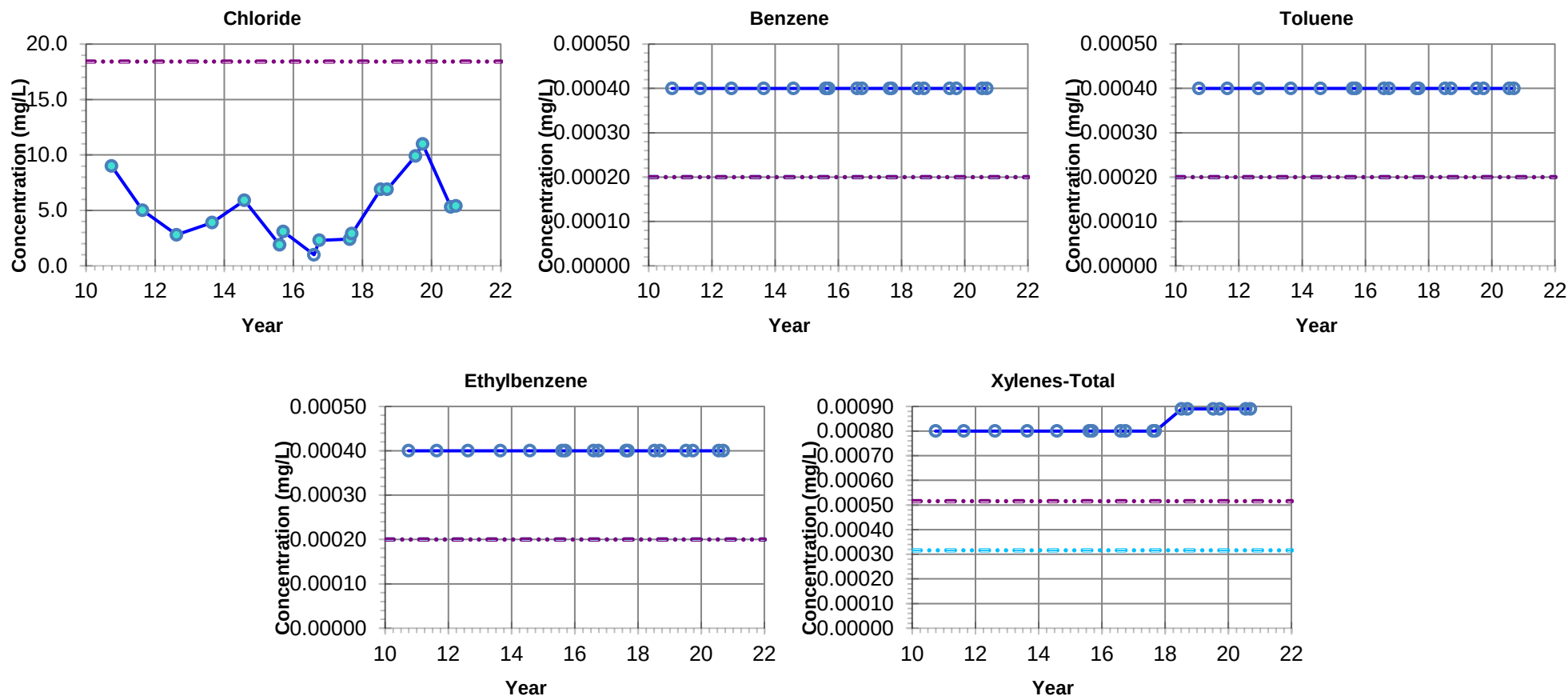
NOTES:

- Filled symbols denote Sample Values
- Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

- - - Upper Control Limit
 - - - Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: BIS 97-1-3								Advisian Worley Group											
17-Feb-2022		date		NA		edited by		JC		drawn by		NA		app by		PROJECT NUMBER:		Figure	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.												417085-31872-21100				F-13			

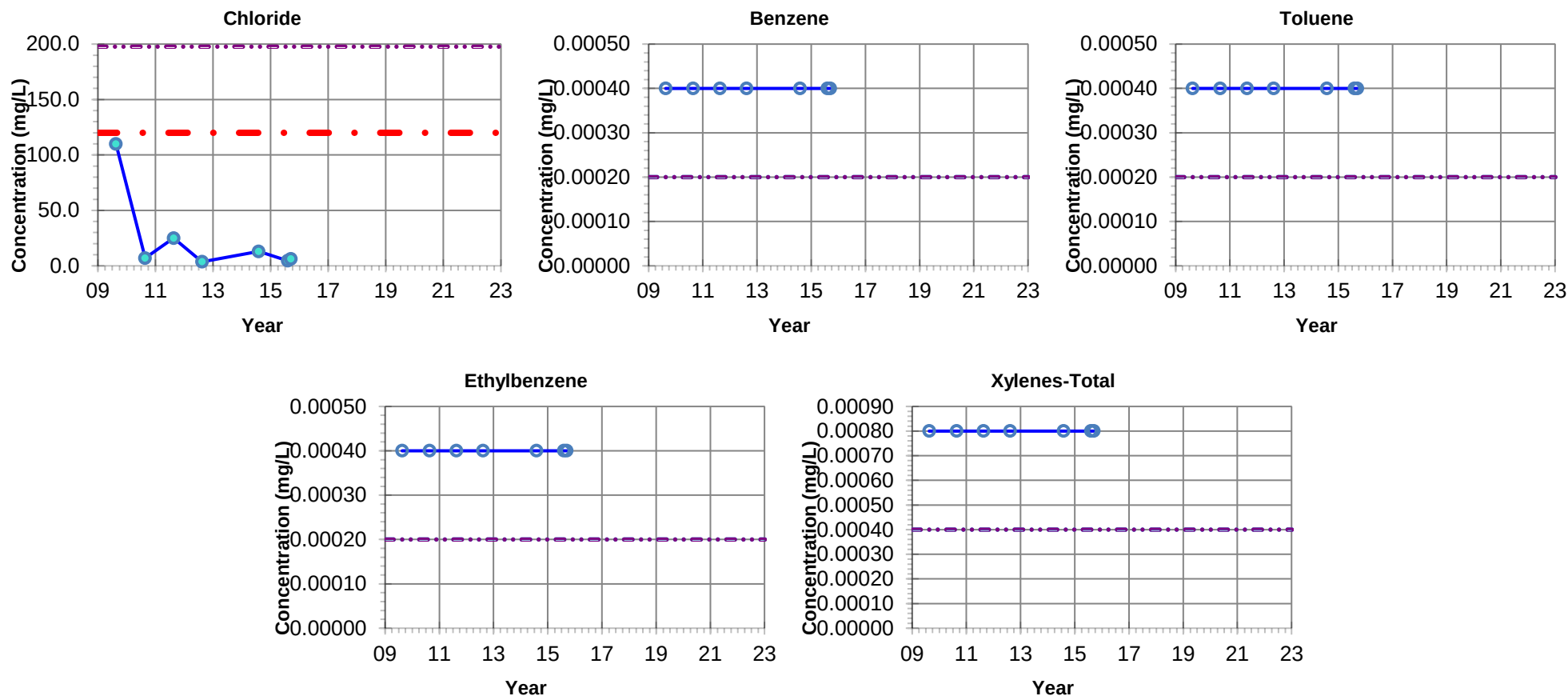


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

- - - Upper Control Limit
 - - - Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: GIBG-10-2-3								Advisian Worley Group				
17-Feb-2022		date	NA		edited by	JC		drawn by	NA		app by	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.										PROJECT NUMBER: 417085-31872-21100		Figure F-14

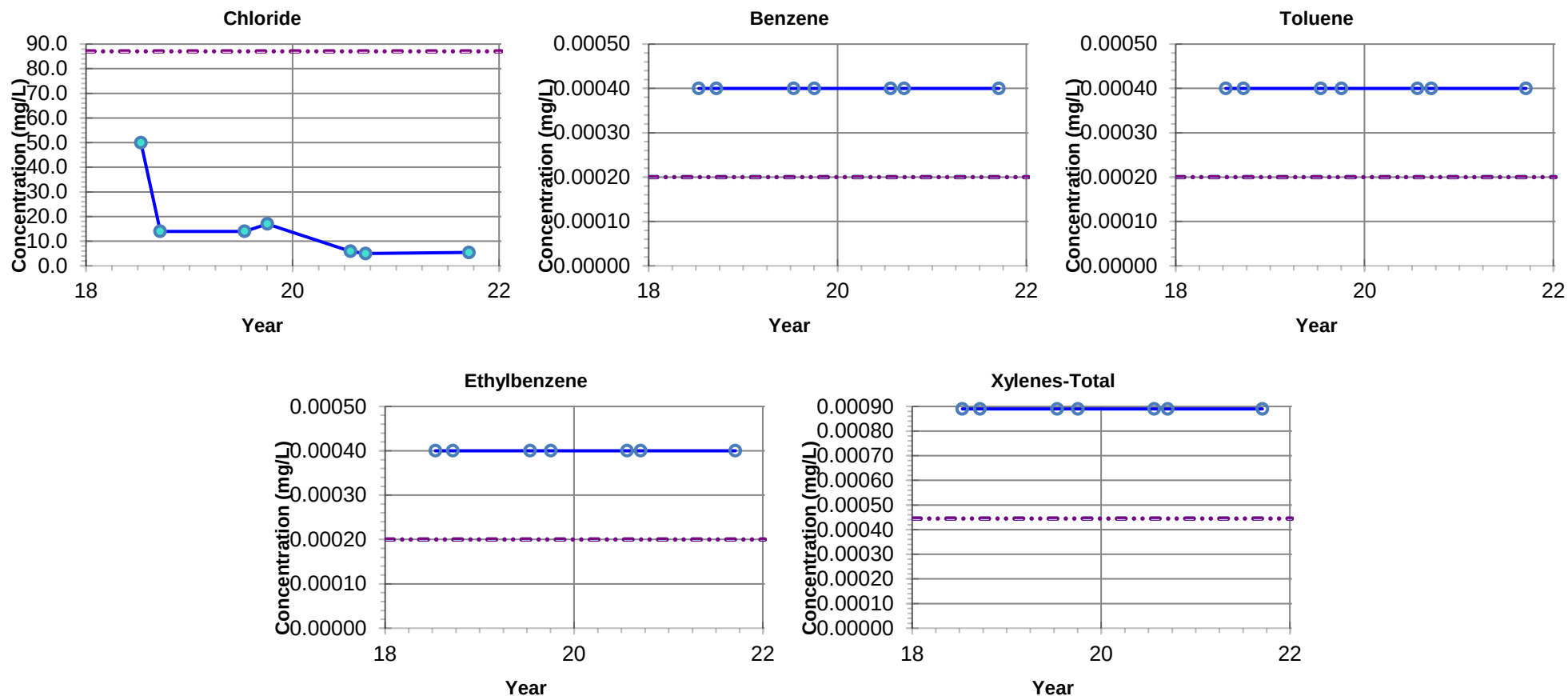


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

- - - **GUIDELINE:**
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

- - - **Upper Control Limit**
 - - - **Lower Control Limit**

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: GIP11 09-1-4						Advisian Worley Group			
17-Feb-2022	date	NA	edited by	JC	drawn by	NA	app by	PROJECT NUMBER: 417085-31872-21100	Figure F-15
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.									

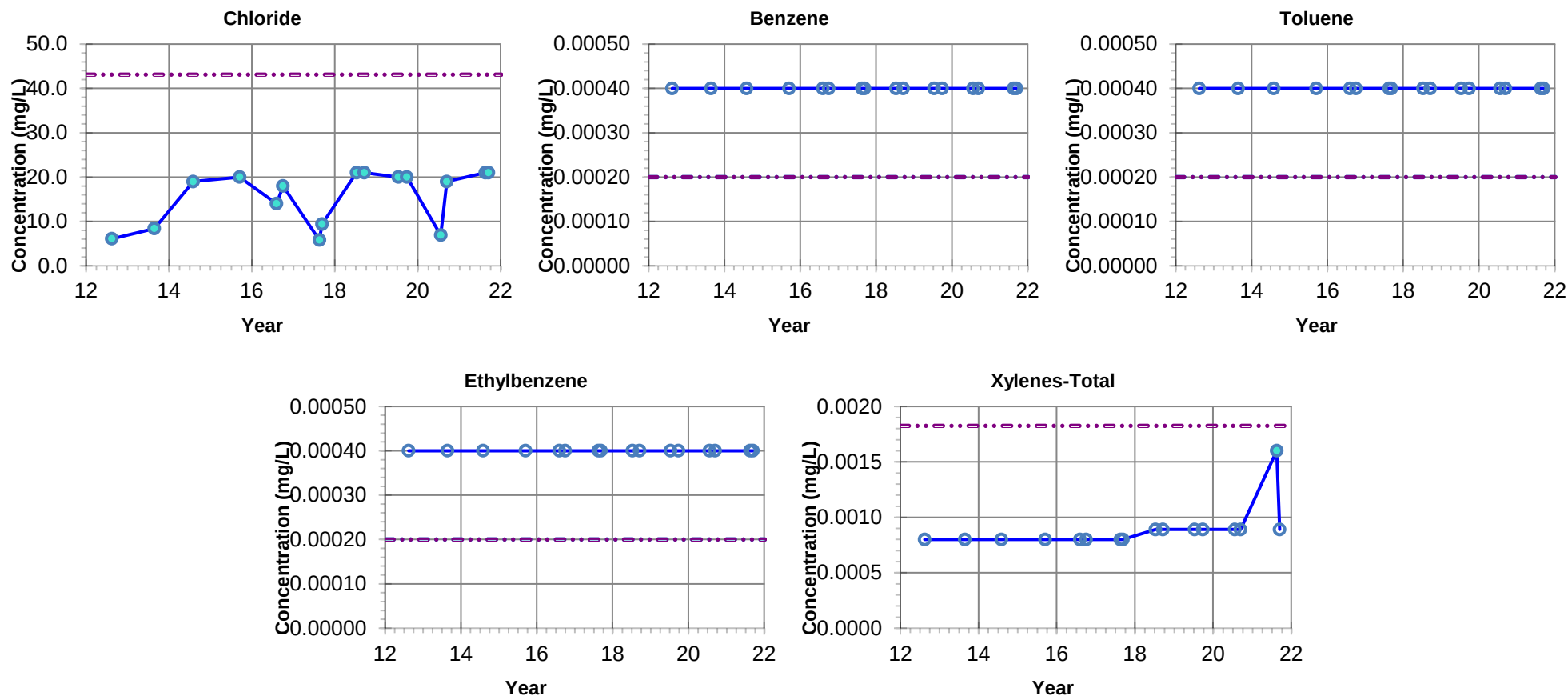


NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

- - - Upper Control Limit
 - - - Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: GIP11 09-1-4-R								Advisian Worley Group											
17-Feb-2022		date		NA		edited by		JC		drawn by		NA		app by		PROJECT NUMBER:		Figure	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.																417085-31872-21100		F-16	



NOTES: - Filled symbols denote Sample Values
 - Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
 CCME CEQG Freshwater Aquatic Life
 -Chloride = 120 mg/L
 -Benzene = 0.37
 -Toluene = 0.002 mg/L
 -Ethylbenzene = 0.09 mg/L

- - - Upper Control Limit
 - - - Lower Control Limit

Imperial 2021 Groundwater Surveillance Network Program Norman Wells, NT Trend Graphs Monitoring Well: GIQ8-10-2-4								Advisian Worley Group				
17-Feb-2022		date	NA		edited by	JC		drawn by	NA		app by	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS HAS NOT ENTERED INTO A CONTRACT.										PROJECT NUMBER: 417085-31872-21100		Figure F-17